

Alabama Statewide Airport Pavement Management Program Update



**Evergreen Regional – Middleton
Field (GZH)**

Final Report

February 2022



Submitted to

Alabama Aeronautics Bureau

Submitted by



All About Pavements, Inc (API)
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Pavement Management – Evaluation – Testing – Design

**ALABAMA STATEWIDE AIRPORT PAVEMENT MANAGEMENT
PROGRAM UPDATE**

Evergeen Regional Airport – Middleton Field, Evergreen (GZH)

FINAL REPORT

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Executive Summary

The Aviation Inc. team, which included All About Pavements, Inc., (API) was awarded a contract by the Alabama Department of Transportation’s Aeronautics Bureau (ALDOT) in 2018 to update the existing Alabama Statewide Airport Pavement Management Program (APMP). The scope of this project includes the airside pavement network at Evergreen Regional Airport – Middleton Field (GZH).

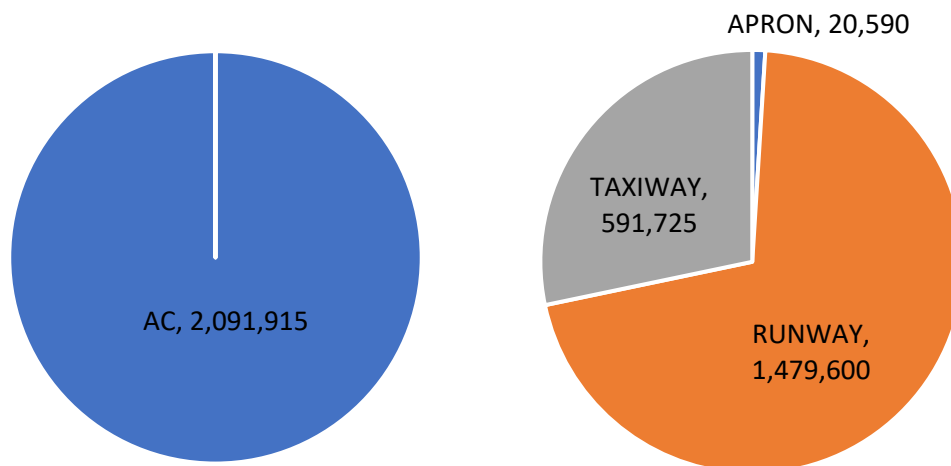
The following APMP tasks were completed to achieve the project objectives at GZH:

- Update the PAVER work history with records review information provided by ALDOT
- Conduct a visual pavement condition survey of the airfield pavements
- Update the PAVER database with inventory and condition data
- Update Maintenance and Rehabilitation (M&R) policies and unit costs
- Develop a 7-Year Pavement Capital Improvement Program (PCIP) with associated cost estimates

ES.1 Pavement Inventory

There are 10 branches and 18 sections within GZH’s pavement network with a total surface area of approximately 2.1 million square feet (sf). Figure ES-1 shows the distribution of the pavement network by surface type and branch use.

Figure ES-1: Pavement Area (sf) by Surface Type and Branch Use.



ES.2 Pavement Condition

Visual pavement inspections were conducted in November 2019 using the Pavement Condition Index (PCI) method as specified in ASTM D5340-12 and FAA AC 150/5380-6C. The PCI is a numerical rating scale from 0 to 100 that provides a measure of the pavement’s functional surface condition. The overall



area-weighted network PCI (AW PCI) for the GZH pavement network is 82, representing a “Satisfactory” condition. The network area-weighted pavement age (AW Age) is greater than 20 years.

Table ES-1 is a listing of the section PCI values and ratings.

Table ES-1: GZH Section PCI Values and Ratings.

Branch ID	Name	Section ID	Surface	Area, sf	PCI	PCI Category
A01	Apron 01	01	AC	20,590	66	Fair
R0119	Runway 01-19	01	AC	150,000	75	Satisfactory
R0119	Runway 01-19	02	AC	446,250	100	Good
R0119	Runway 01-19	03	AC	132,750	100	Good
R1028	Runway 10-28	01	AC	600,600	100	Good
R1028	Runway 10-28	02	AC	150,000	95	Good
T01	Taxiway 01	01	AC	26,437	36	Very Poor
T02	Taxiway 02	01	AC	12,365	66	Fair
TC01	Taxiway Connector 01	01	AC	13,778	39	Very Poor
TC02	Taxiway Connector 02	01	AC	13,598	37	Very Poor
THANG01	Taxiway Hangar 01	01	AC	27,392	60	Fair
TP01	Taxiway Parallel 01	01	AC	69,869	92	Good
TP01	Taxiway Parallel 01	02	AC	158,755	40	Very Poor
TP01	Taxiway Parallel 01	03	AC	16,126	38	Very Poor
TP01	Taxiway Parallel 01	04	AC	39,671	39	Very Poor
TP02	Taxiway Parallel 02	01	AC	21,793	37	Very Poor
TP02	Taxiway Parallel 02	02	AC	14,632	39	Very Poor
TP02	Taxiway Parallel 02	03	AC	177,309	39	Very Poor

ES.3 Pavement Maintenance and Repair Funding Levels

The PAVER database was updated with 2019 condition data, maintenance and repair (M&R) policies, and unit costs; which were then used to evaluate the effect of multiple funding levels on the overall future pavement condition. Figure ES-2 presents the forecasted GZH network PCI values for each funding level. As directed by ALDOT, Runways 01-19 and 10-28 were excluded from the PCIP.

ES.4 Pavement Capital Improvement Program (PCIP)

The analysis output from the unlimited funding budget scenario was used as a starting point in developing the PCIP. For this scenario, sections were grouped into projects to allow for a logical construction sequence. Table ES-2 summarizes the 7-year PCIP, which has an estimated total cost of approximately \$5.8 million. These recommendations are based on a network-level evaluation. Project-level evaluations should be conducted prior to developing design and bid package documents.



In addition to the major rehabilitation needs that are identified in the PCIP, PAVER was used to develop maintenance activities to repair specific PCI distresses in Year 1. The estimated costs for these maintenance activities are \$9,043 as summarized in Table ES-3.

Figure ES-2: M&R Funding Levels.

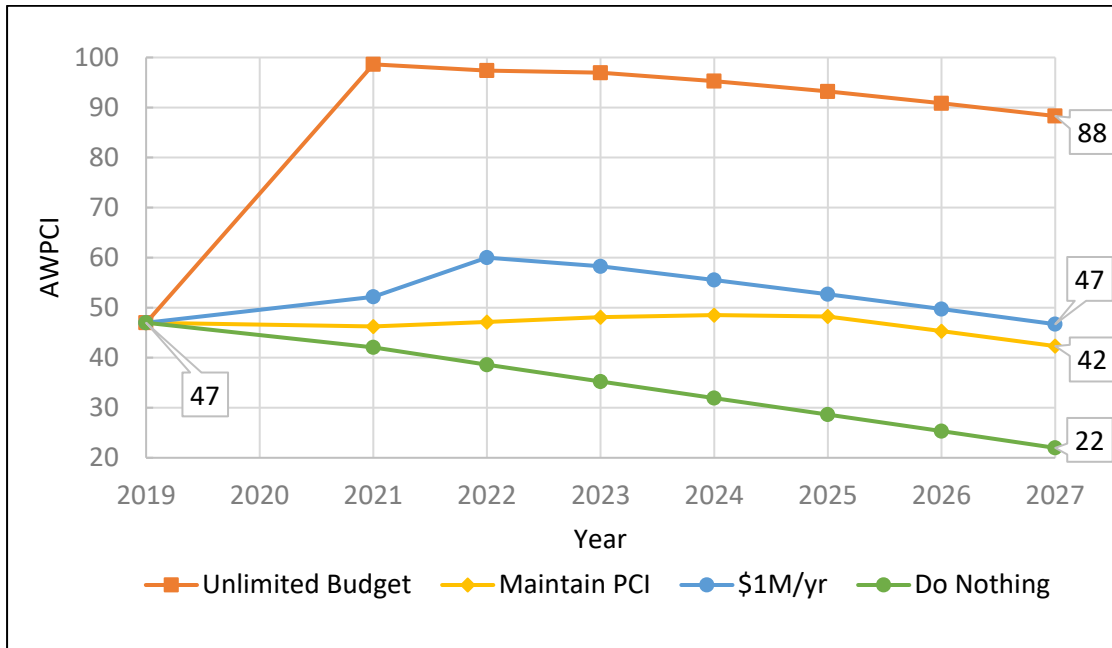


Table ES-2: Summary of Pavement Capital Improvement Program.

Project Year	CIP Project	Total Project Cost	Total Project Area, sf	AWPCI Before	AWPCI After
2021	GZH_21-01_Taxiway Parallel 01 Rehabilitation	\$2,383,448	298,199	55	99
2022	GZH_22-01_Taxiway Hangar Rehabilitation	\$305,187	60,347	54	100
2023	GZH_23-01_Taxiway Parallel 02 Reconstruction	\$2,738,104	253,769	26	100
2024	GZH_24-01_Taxiway Parallel 01 Surface Treatment	\$145,316	228,330	96	99
2025	GZH_25-01_Apron 01 Surface Treatment	\$21,603	32,955	94	98
2026	GZH_26-01_Taxiway Parallel 02 Surface Treatment	\$171,342	253,769	96	99
Total		\$5,765,000			

Table ES-3: Summary of Localized Maintenance Plan.

Policy	Work Description	Work Quantity	Work Unit	Work Cost
Preventive	Crack Sealing - AC	614	Ft	\$2,426
	Patching - AC Full-Depth	259	SqFt	\$6,479
Safety	Crack Sealing - AC	35	Ft	\$138
Total				\$9,043

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1 Introduction

1.1. Overview

The Alabama Department of Transportation's Aeronautics Bureau (ALDOT) is responsible for preserving and enhancing Alabama's air transportation system, which consists of 74 general aviation airports throughout the State. ALDOT implemented an Airport Pavement Management Program (APMP) in 2008 using the PAVER system. ALDOT awarded a project in 2018 to Aviation Inc. (Aviation) to update the System Plan and conduct an Economic Analysis for the Alabama airports. The scope of work also included an update of the APMP for 59 general aviation airports, which was conducted by All About Pavements, Inc., (API), a Aviation team member.

With this update of the APMP, the Alabama airports continue to be eligible for FAA funding for major pavement rehabilitation work under the Airport Improvement Program (AIP) since an APMP meets the pavement maintenance management requirements described in Appendix A of AC 150/5380-6C.

This report discusses the evaluation of the airside pavements at Evergreen Regional Airport – Middleton Field (GZH), the current and forecasted pavement condition, and the development of the Pavement Capital Improvement Program (PCIP).

1.2. Work Scope

The goals of the Alabama Statewide Airport Pavement Management Update program are as follows:

- Conduct a visual pavement inspection of the asphalt surfaced pavements for 59 of the 74 general aviation airports in Alabama.
- Based on the visual inspection analysis results, develop a 7-year PCIP for each airport.

The scope of work is as shown below:

- Conduct a Records Review
- Update Pavement Network Definition
- Conduct Pavement Condition Surveys
- Update and customize existing APMP PAVER database
- Develop PCIP and associated project cost estimates
- Prepare Draft and Final Reports
- Develop a web-based viewer for reporting APMP data

As required in the Scope of Work, a detailed pavement condition survey was not conducted for any Portland Cement Concrete (PCC) aprons and PCC taxiways longer than 2,000 ft. Instead, a condition rating of "Good", "Fair", or "Poor" was assigned based on the overall pavement condition.

The deliverable products include a PAVER 7.0 database, individual airport evaluation reports, a statewide summary report, and the web viewer. The GZH report will be one of the 59 individual airport reports that will be available on ALDOT's website.



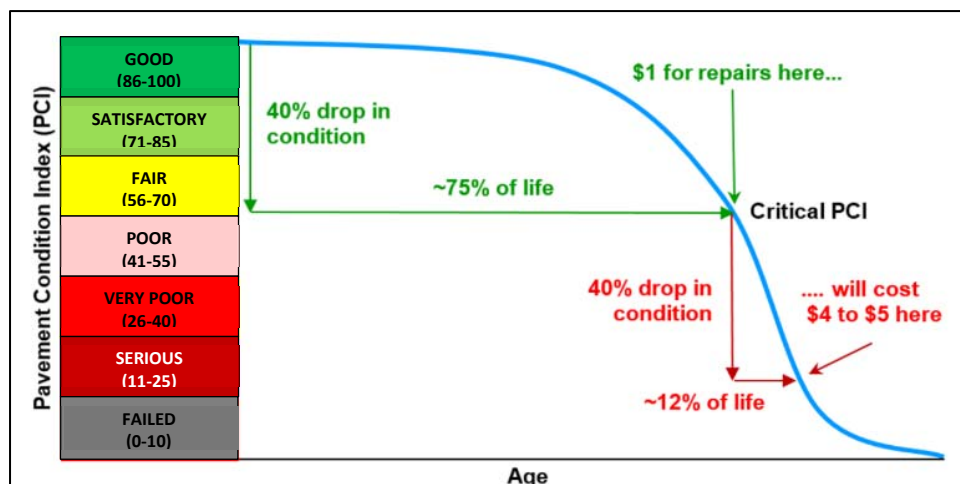
1.3. Pavement Management Concept

An APMP provides an integrated framework for comprehensive evaluation and decision making for managing airfield pavements. The essential components of an effective APMP provide for an objective evaluation of the condition of existing pavements, identification of short-term and long-range major rehabilitation work, necessary improvements in the pavement structural capacity, and the recurring maintenance work that should be completed each year. The APMP will also provide a budget for each of these types of pavement construction.

Historically, most organizations have made maintenance decisions based on past experience, without the benefit of documented data or analysis. This practice does not encourage life cycle cost analysis, nor the evaluation of cost effectiveness of alternate scenarios, and can lead to the inefficient use of funds. With limited allocated funding for Maintenance and Repair (M&R) Program projects, a defined procedure for setting priorities and schedules that will maximize the funds available is more important than ever.

In examining the lifespan of a 20-year pavement, a “Good” to “Fair” condition rating may last only 5 to 15 years. After that point, the rate of deterioration of pavements accelerates sharply as the age of the pavement increases, and within five years, the pavement may deteriorate to the point of failure. In order to extend pavement life, maintenance and repairs need to be scheduled and performed before the pavement surface declines to a “fair” condition. The point at which rehabilitation can be done before the steep decline occurs is called the “critical PCI”, and is generally considered to occur when the Pavement Condition Index (PCI) is between 60 and 70 for general aviation airports. If the work is done before deterioration accelerates, the cost of rehabilitation can be reduced as shown in Figure 1.1.

Figure 1.1: Pavement Management Concept.



2 Airfield Pavement Inventory

2.1. Introduction

GZH is a General Aviation (GA) airport located approximately 5 miles west of Evergreen. The airport was activated in August 1945 and is owned and operated by the City of Evergreen. Figure 2.1 shows an aerial image of the airport.

Figure 2.1: Evergreen Regional Airport – Middleton Field.



(Source: Google Earth)

2.2. Pavement Inventory

GZH consists of two runways, parallel taxiways, multiple connector taxiways, and an apron. The total pavement area is approximately 2,1 million square feet. All pavements at GZH are Asphalt Concrete (AC) surfaced. A complete listing of the pavement sections is included in Appendix A. Runway 01-19 is 5,005 ft. long and 150 ft. wide. Runway 10-28 is 5,004 ft. long and 150 ft. wide.

A records search was undertaken to identify any preservation or rehabilitation work that has occurred at GZH since the last APMP update in 2009. The records for the taxiway extension in 2016 that were provided by ALDOT were reviewed, and the PAVER database was updated with work history information.



2.3. Climatic Conditions

Table 3.1 provides a summary of the climatic data for the geographic region that includes GZH. As the table shows, the pavements at GZH are not exposed to any freeze-thaw cycles. The mean air temperature for January ranges from an average low of 37 degrees °F to an average high of 58 degrees °F. The average annual rainfall at GZH is near 63 inches.

Table 2.1: Average Annual Temperatures and Rainfall for GZH.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Temp (°F)	58	63	71	77	83	89	91	90	86	78	68	61
Low Temp (°F)	37	39	45	51	60	67	71	70	66	54	45	39
Precip. (in)	6.5	5.6	7.4	5.1	5.3	4.5	6.7	4.6	4.8	2.7	4.7	5.1

Source: www.intellicast.com

2.4. Pavement Network Definition

A key element in developing an APMP system is defining the pavement network, which is the process of dividing an agency’s pavements into a hierarchical order that facilitates inspection and M&R planning. The GZH network (e.g. all airside pavements) is then divided into branches, which are a readily identifiable part of the pavement system and have distinct functions. For airports, branches typically consist of individual runways, taxiways and aprons. Figure B1A in Appendix B shows the branches at GZH.

Once branches have been defined, pavement evaluation and analysis techniques require the airfield pavement system to be broken up into discrete sections. A pavement “section” is the smallest management unit that is used when considering the application and selection of maintenance and rehabilitation (M&R) treatments, and is defined in Section 2.1.8 of ASTM D 5340-12 as “a contiguous pavement area having uniform construction, maintenance, usage history, and condition. A section should also have the same traffic volume and load intensity.” A complete list of the pavement inventory and the corresponding section designations are included in Appendix A. Figure B1B presents the section layout.

To facilitate the visual survey of the airside pavement, each section is further subdivided into conveniently defined sub-section areas, or sample units. Similar sizing is critical as studies have found that maintaining the size of the sample units to within 40 percent of the established norm may reduce the standard error of the average PCI values. To meet that criteria, ASTM recommends that sample units for asphalt pavements be 5,000 square feet (± 2,000).

Table 2.2 was used as a guideline in developing sampling rates that reflect typical rates that are used for other large pavement networks. In general, this sampling rate will not provide a 95% confidence level with a standard error of 5 PCI points. A higher level of sampling is recommended before a project-level rehabilitation design is developed for a pavement section or facility.



Sample units that include a one-time occurrence of a distress (i.e. a large patch) or an unusual severity or quantity of a distress seen elsewhere, were designated as “additional” sample units as described in the ASTM D5340 PCI procedure. This allows the PCI to be calculated without extrapolating the aberrant distress throughout the section as a whole. In Appendix B, Figure B1C shows the sample unit layout for GZH.

Table 2.2: PCI Sampling Rate for AC Surfaces.

Total Samples	Samples to Inspect
1	1
2	2
3 – 6	3
7 – 13	4
14 – 39	5
> 39	15 percent, but less than 12

2.5. Inventory Summary

There are 10 branches (facilities) at GZH that include 18 pavement sections and a total area of approximately 2.1 million square feet of paved surfaces, as shown in Table 2.3.

Table 2.3: GZH Pavement Branches.

Branch ID	Branch Name	Branch Use	Area, sf	Number of Sections
A01	Apron 01	APRON	20,590	1
R0119	Runway 01-19	RUNWAY	729,000	3
R1028	Runway 10-28	RUNWAY	750,600	2
T01	Taxiway 01	TAXIWAY	26,437	1
T02	Taxiway 02	TAXIWAY	12,365	1
TC01	Taxiway Connector 01	TAXIWAY	13,778	1
TC02	Taxiway Connector 02	TAXIWAY	13,598	1
THANG01	Taxiway Hangar 01	TAXIWAY	27,392	1
TP01	Taxiway Parallel 01	TAXIWAY	284,421	4
TP02	Taxiway Parallel 02	TAXIWAY	213,734	3
Total			2,091,915	18

Table 2.4 shows the distribution of airfield pavement by age with the area-weighted age being greater than 20 years for all airside pavements at GZH.



Table 2.4: GZH Pavement Age.

Age (Years)	Number of Sections	Percent of Area	Area, sf
0 – 5	1	3	69,869
6 – 10	2	14	300,000
11 – 15	0	0	0
16 – 20	9	70	1,454,957
> 20	6	13	267,089

Figure 2.2 shows the distribution by surface type. Figure 2.3 presents the distribution by pavement use (e.g. runway, taxiway, and apron).

Figure 2.2: GZH Pavement Area by Surface Type.

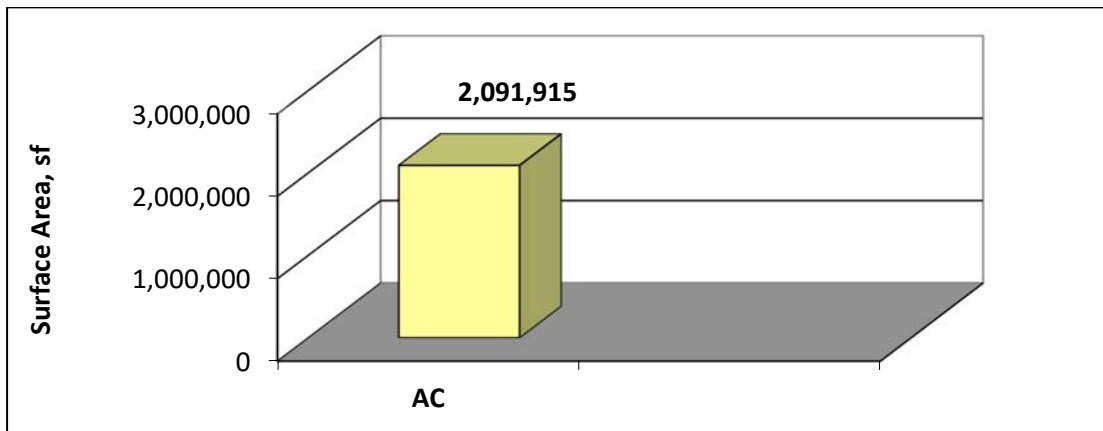
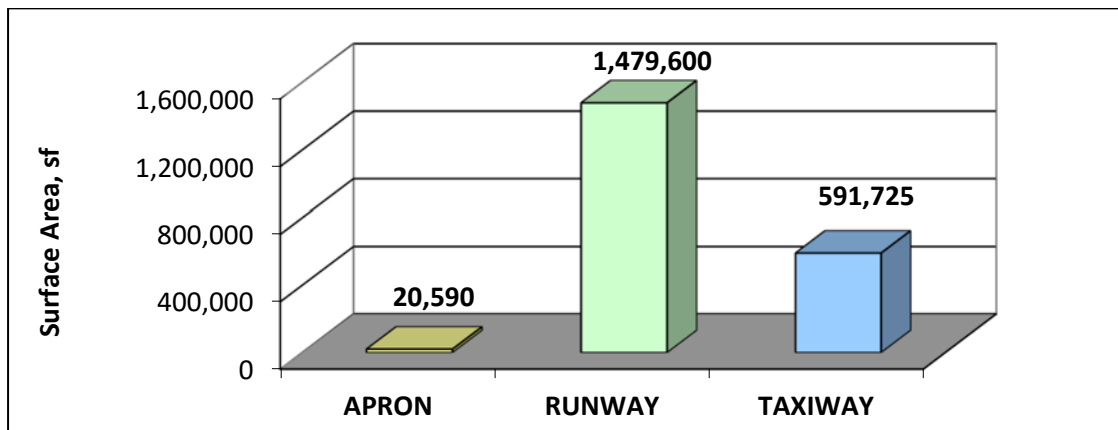


Figure 2.3: GZH Pavement Area by Branch Use.



Maps B1D, B1E, and B1F show the pavement type, branch use, and pavement age, respectively.



3 Pavement Condition

3.1. Introduction

A visual PCI survey of the airside pavements at GZH was conducted in order to assist in the development of a realistic PCIP. The PCI survey measures and records pavement distresses that exist within each of the inspected sample units. This survey was conducted in November 2019 by a 2-person team. The survey was performed in accordance with the methods described in ASTM D 5340-12 and FAA AC 150/5380-7B, using the sampling rates from Chapter 2 of this API report.

During the pavement survey, Quality Control (QC) and data verification were performed on both the individual distresses and the calculated section PCI values. QC included the following activities;

- Review of distress quantities to identify data entry errors (100% review at the sample unit level). General guidance was used from ASTM D5340-12, section 13, which addresses the precision of distress quantities that are recorded during PCI surveys.
- Duplicate surveys were performed to ensure consistency between each of the inspectors in a 2-person PCI survey team.

3.2. Pavement Condition Rating Methodology

The PCI is a measure of the pavement's functional surface condition. It provides insight into the causes of each distress, and whether the distress is primarily caused by load, climatic conditions, and other material related deficiencies. The PCI is a numerical rating (on a scale of 0 to 100) that is based on the type, severity and quantity of each distress that is found in an inspected sample unit.

The PCI survey results are displayed using seven categories and ratings in accordance with the ASTM, but can also be presented using a simplified 3-category rating system for use in comparing with other distress related indices, as shown in Table 3.1.



Table 3.1: Pavement Condition Index Rating Scale.

	Simplified PCI Color Legend	ASTM PCI Color Legend	PCI Range	PCI Ratings and Definition
GOOD			86-100	<u>GOOD</u> : Pavement has minor or no distresses and should require only routine maintenance.
			71-85	<u>SATISFACTORY</u> : Pavement has scattered low-severity distresses that should require only routine maintenance.
FAIR			56-70	<u>FAIR</u> : Pavement has a combination of generally low- and medium-severity distresses. Near-term maintenance and repair needs may range from routine to major.
POOR			41-55	<u>POOR</u> : Pavement has low-, medium-, and high-severity distresses that probably cause some operational problems. Near-term M&R needs range from routine to major. requirement for
			26-40	<u>VERY POOR</u> : Pavement has predominantly medium- and high-severity distresses that cause considerable maintenance & operational problems. Near-term M&R needs will be major.
			11-25	<u>SERIOUS</u> : Pavement has mainly high-severity distresses that cause operational restrictions; immediate repairs are needed.
			0-10	<u>FAILED</u> : Pavement deterioration has progressed to the point that safe aircraft operations are no longer possible; complete reconstruction is required.

3.3. Distress Types

The ASTM D5340 standard considers 17 distresses, which tend to fall into one of the following four cause categories:

- Load related: AC distresses include alligator cracking, corrugation, depression, polished aggregate, rutting and slippage cracking; PCC distresses include corner breaks, longitudinal cracking, divided slabs, polished aggregate, pumping and joint spalling.
- Climate and durability related: AC distresses include bleeding, block cracking, joint reflection cracking, longitudinal and transverse (L&T) cracking, swelling, raveling, and weathering; PCC distresses include blow-ups, “D” cracking, longitudinal cracking, pop-outs, pumping, scaling, shrinkage cracks, and joint and corner spalling.
- Moisture & Drainage related: AC distresses include alligator cracking, depressions, potholes and swelling; PCC distresses include corner breaks, divided slabs and pumping.
- Other factors: Oil spillage, jet blast erosion, bleeding, patching and concrete slab joint faulting.

As described above, distress may have more than one cause. For example, depressions may be caused by incorrect compaction during construction, or by subgrade softening due to environmental factors. In addition, a distress may be initiated by one cause but may progress to a distress of higher severity by another cause. Therefore, engineering judgment is critical in analyzing the actual causes of the distress.

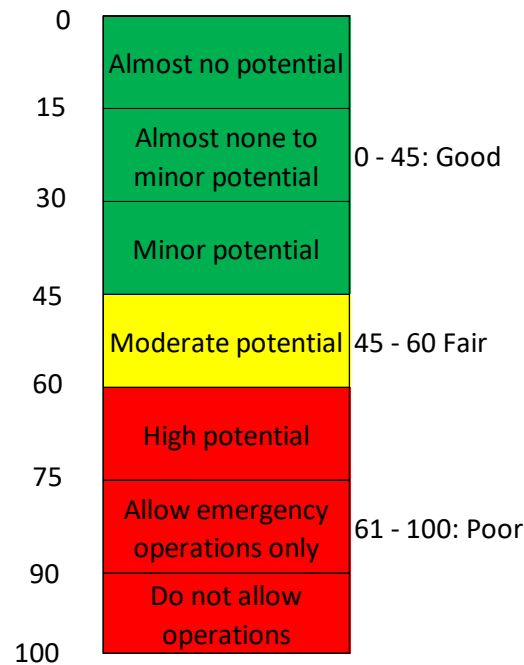
Distress descriptions provided in Appendix C were taken from the “PCI Field Manual,” developed by the U.S. Army Construction Engineering Research Lab (CERL), latest edition. Appendix C provides a detailed explanation of each type of AC and PCC surface distress.

3.4. Additional PCI-based Indices

The distress data used to compute PCI can also be used to calculate additional indices that are helpful in understanding the condition of the pavement and developing PCIP recommendations. One additional index that was computed is the Foreign Object Damage (FOD) potential index.

The FOD index was developed by the US Air Force and is described in detail in the US Army Corp of Engineers Engineering Technical Letter (ETL) 04-09, Pavement Engineering Assessment (EA) Standards. Loose objects on an airfield pavement surface resulting from pavement distresses can be detrimental to aircraft engines, specifically engines that are low to the ground. The objects are ingested into the engines causing costly damage and presenting a safety hazard. Not all pavement distresses create a FOD potential. Therefore, an additional index was identified that uses the results of the PCI distress survey. As shown in Figure 3.1, the scale ranges from 0 to 100 with 0 being no FOD potential. Note that the FOD index uses a simplified three color scale.

Figure 3.1: FOD Potential Rating Scale.





3.5. PCI Survey Results

The airside pavements at GZH include 18 sections with 419 sample units. The sample number of sample units that were surveyed in the field is 103, which is 25 percent of the total samples. Data from the inspected sample units were input into the PAVER database and a resultant PCI for each section was computed.

Figure 3.2 presents the area-weighted PCI by use and the overall airside network.

Figure 3.2: Pavement Condition by Branch Use.

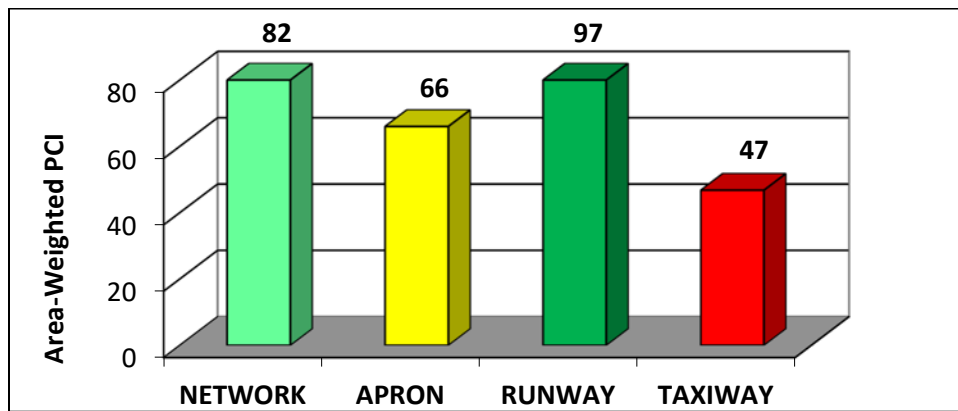


Figure 3.3 shows the distribution of the GZH pavement network by condition. Approximately 23 percent of the network is in “Poor” or worse condition.

Figure 3.3: Pavement Condition by Percent of Area.

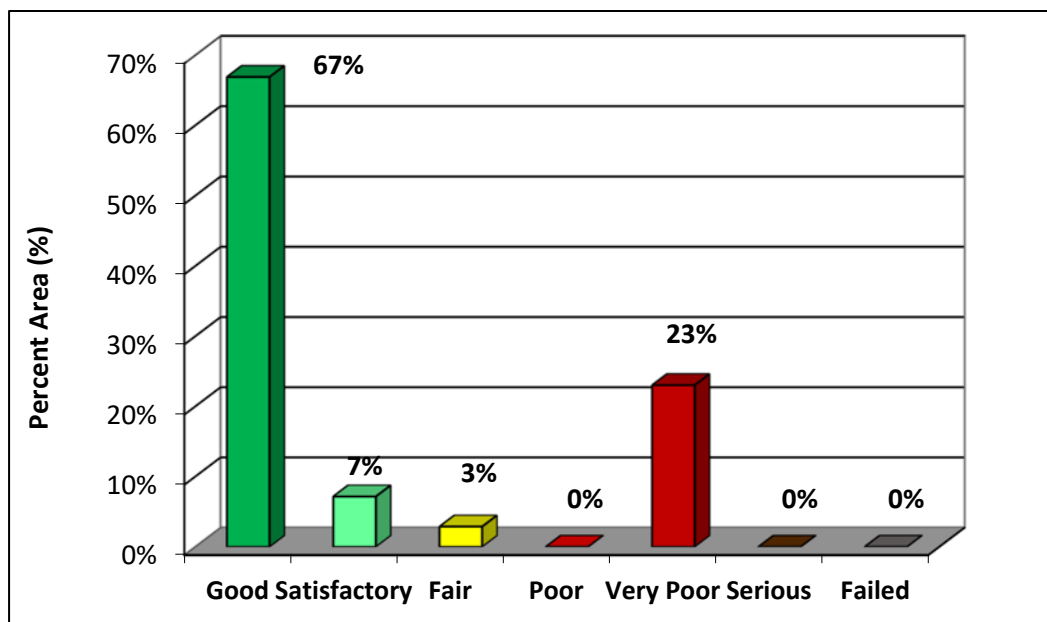


Table 3.2 is a listing of the section PCI.

Table 3.2: Section PCI.

Branch ID	Name	Section ID	Surface	Area, sf	PCI	PCI Category	FOD
A01	Apron 01	01	AC	20,590	66	Fair	48
R0119	Runway 01-19	01	AC	150,000	75	Satisfactory	38
R0119	Runway 01-19	02	AC	446,250	100	Good	0
R0119	Runway 01-19	03	AC	132,750	100	Good	0
R1028	Runway 10-28	01	AC	600,600	100	Good	0
R1028	Runway 10-28	02	AC	150,000	95	Good	14
T01	Taxiway 01	01	AC	26,437	36	Very Poor	73
T02	Taxiway 02	01	AC	12,365	66	Fair	48
TC01	Taxiway Connector 01	01	AC	13,778	39	Very Poor	74
TC02	Taxiway Connector 02	01	AC	13,598	37	Very Poor	77
THANG01	Taxiway Hangar 01	01	AC	27,392	60	Fair	52
TP01	Taxiway Parallel 01	01	AC	69,869	92	Good	16
TP01	Taxiway Parallel 01	02	AC	158,755	40	Very Poor	74
TP01	Taxiway Parallel 01	03	AC	16,126	38	Very Poor	72
TP01	Taxiway Parallel 01	04	AC	39,671	39	Very Poor	75
TP02	Taxiway Parallel 02	01	AC	21,793	37	Very Poor	77
TP02	Taxiway Parallel 02	02	AC	14,632	39	Very Poor	75
TP02	Taxiway Parallel 02	03	AC	177,309	39	Very Poor	75

Figure B2A and B2B in Appendix B are maps of the section PCI in 7- and 3-scale categories, respectively. Figures B2C is a map of the FOD rating. Appendix D contains a detailed report of the PCI values and distress type, quantity, and severity data for each sample unit that was surveyed in a section. Appendix E is a summary report of the extrapolated distress data at the section level.

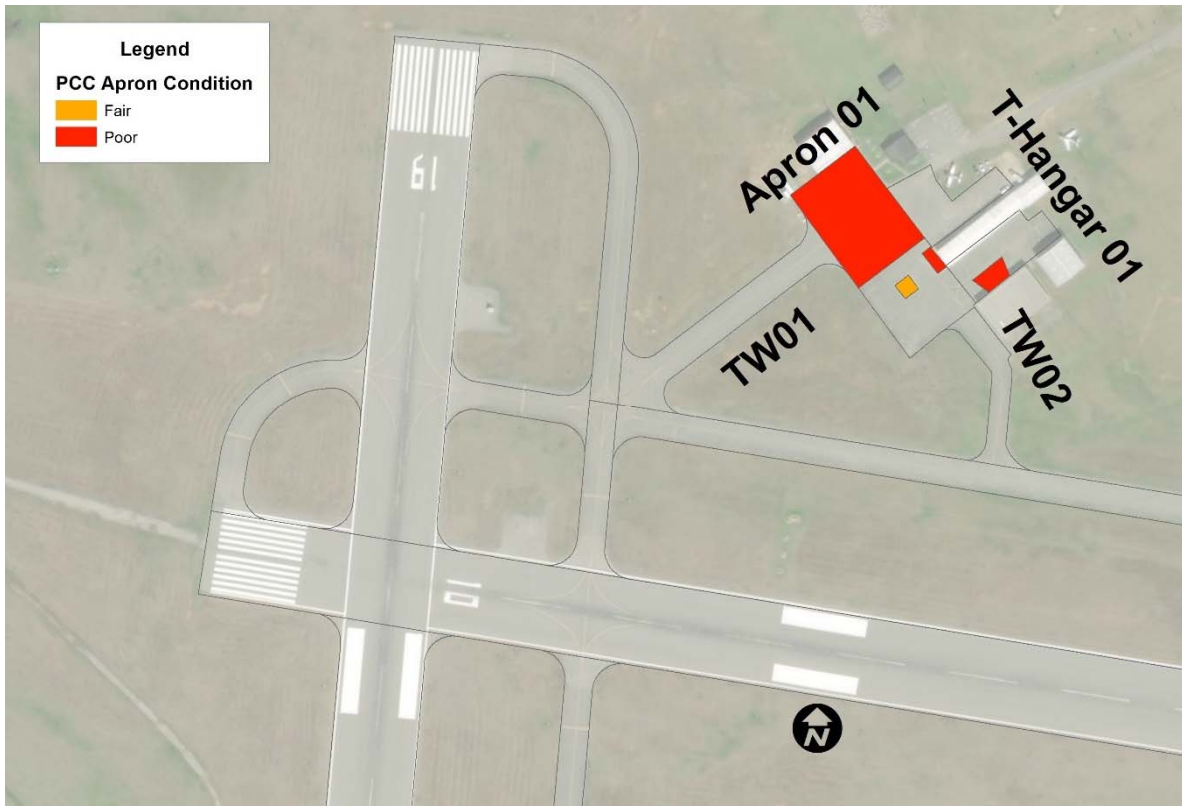
Appendix F contains current section and branch PCI data and forecasted section PCI values. FOD values by section and branch are also presented. Figure B2D in Appendix B shows the locations of the photos that were taken during the survey. Photos are included in Appendix J.

3.6. PCC Pavements

As stated earlier, the project scope did not include a detailed pavement condition survey for any Portland Cement Concrete (PCC) aprons. For these pavements, a rating of “Good”, “Fair”, or “Poor” was assigned based on the overall pavement condition. Figure 3.4 shows the condition of the PCC aprons at GZH.



Figure 3.4: PCC Apron Condition Rating.



4 Pavement Capital Improvement Program

4.1. Introduction

PCI data were collected and entered into the PAVER database. In addition, the database customization included the following components, which are described in detail in this chapter.

1. Performance Modeling
2. Maintenance & Repair (M&R) Triggers (Critical PCI)
3. M&R Policies
4. Unit Costs

Once the database was customized, it was used to run budget analysis scenarios and develop a 7-year PCIP.

4.2. Performance Modeling

To determine long-term M&R needs, a APMP must be able to predict future pavement condition. Future pavement condition is predicted using equation models that are generated from current and historical PCI data. Equation models are developed by grouping pavements based on similar performance characteristics such as region, construction history, surface type, traffic, priority and use. Mathematical techniques such as straight-line extrapolation and regression that include boundary and outlier filters are used to develop models that provide the best fit equation for the pavement condition data. PAVER's Prediction Modeling module was used to develop pavement performance models that are commonly referred to as 'Family Curves'.

Prediction models are used at the section level to compute future conditions based on the typical performance of the pavement sections that are included in each model. Future condition is computed by defining its position relative to the prediction model. The section prediction curve, or equation, is drawn through the current PCI-age point for each specific section. Since the shifted curve will run parallel to the computed prediction model, the predicted condition can be computed for any future age. Figure 4.1 is an illustration of this process.

Prediction models provide an effective way to compute future pavement performance based on past and current conditions, and pavement maintenance and rehabilitation practices. As new PCI inspection surveys are conducted, these models should be updated accordingly. In the case of the Alabama statewide airport pavement network, the best fit family curves were developed for each region by grouping pavements according to branch use (e.g. runway, taxiway) and surface type (e.g. AC, AAC, and APC). The family curves for ALDOT were developed based on branch use and are presented in Figure 4.2.



Figure 4.1: PCI Forecasting.

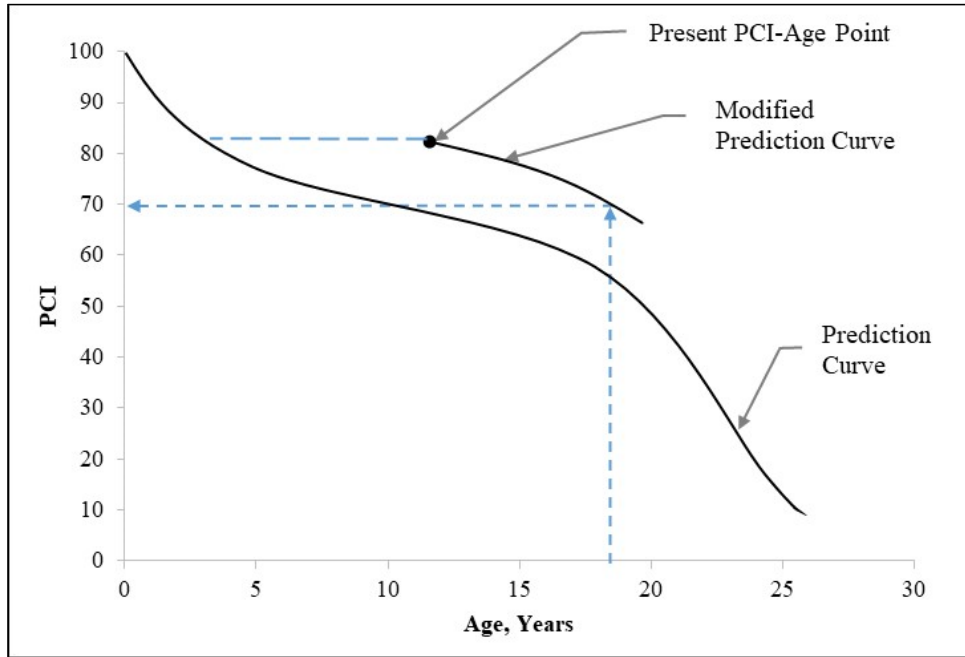
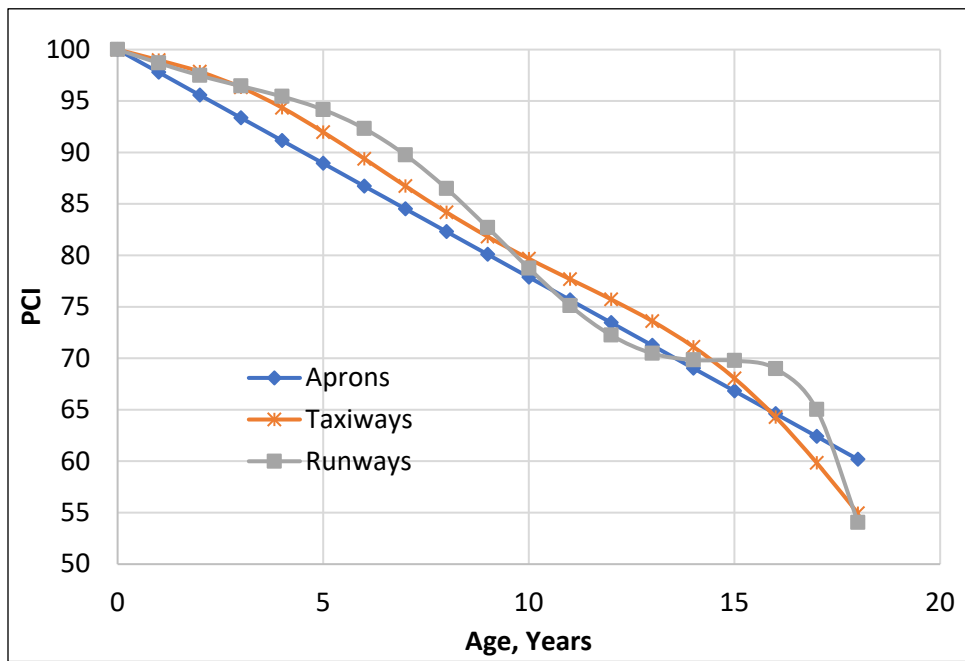


Figure 4.2: Family Curves.



4.3. Critical PCI Values

The Critical PCI value is defined as “*the PCI value at which the rate of PCI loss increases with time, or the cost of applying localized preventive maintenance increases significantly.*” This definition is incorporated into PAVER in defining and measuring the critical PCI values. These values, or M&R triggers, are assigned for each prediction model. As such, the critical PCI values are directly related to the branch use.

These critical PCI levels are selected based on several factors including a review of performance models; experience; other airport triggers; and acknowledge that time is required for funding approval and design. Note that preventive maintenance is recommended, and it should generally be performed above the critical PCI (trigger) values and Major M&R is generally performed below them. The critical PCI (CP) values were set at 70 for runways and taxiways, and 65 for other pavements.

4.4. M&R Policies and Unit Costs

M&R policies refer to the activities that are applied at different condition levels to maintain and repair a pavement section.

Maintenance activities are localized activities which are typically assigned in the first year of the M&R plan based on the observed distresses. Safety (stopgap) maintenance addresses distresses that would affect operational safety if left unrepaired and is applied to pavements below the critical PCI. Preventive maintenance activities are aimed at slowing the rate of deterioration through consistent maintenance of existing pavements and are generally applied to pavements above the critical PCI. Appendix G presents the policies for preventive and safety maintenance.

Repair activities are conducted for larger areas, typically at the section level and are assigned based on the critical PCI. Repair activities broadly consist of three categories: preservation, rehabilitation, and reconstruction. Pavement preservation involves activities like surface treatments that are used to extend pavement service life and to delay more expensive rehabilitation work. These are applied when the pavement is in relatively good condition and does not exhibit any structural distress. Rehabilitation activities are used to repair pavements below or around the critical PCI and typically include mill and overlay. Reconstruction is recommended when the pavement has deteriorated to a level where rehabilitation is no longer cost effective.

Table 4.1 lists the pavement activity types, the individual activities within each type, and their associated 2020 unit costs. A more detailed description of the M&R activities and the development of the M&R unit costs is presented in Appendix H.

In accordance with ALDOT’s focus on preservation, surface treatment is applied to all resurfaced and reconstructed runways, taxiways, and aprons three years after construction work is complete. Taxilanes and T-Hangar pavements are excluded from this requirement. This policy is applicable for projects in the PCIP between 2021 and 2024. For cost estimating, this surface treatment is assumed to have the same cost as the runway surface treatment.



Table 4.1: M&R Activities and Unit Costs.

Activity Type	PCI	Activity	Cost/sf
Maintenance	Note 1	Seal Cracks – AC (\$/lf)	\$3.95
		AC Full-Depth Patching	\$25.05
		AC Partial-Depth Patching	\$16.28
Preservation	75-90	Runway Surface Treatment	\$0.57
		Taxiway and Apron Surface Treatment	\$0.85
Rehabilitation	> CP	2" AC OL ²	\$3.91
	55 - CP	Mill 2" & 2" AC OL	\$4.27
	45 - 55	Mill 2" & 2" AC OLP (With Pre-Overlay Repairs)	\$5.37
Reconstruction	0 - 45	AC Reconstruction	\$9.87

¹ Preventive > CP; Safety (Stopgap) < CP

² For sections with structural distress and PCI > CP

4.5. Pavement CIP Development

The PAVER database, updated with condition data and customized with condition performance priorities, policies, and costs; was used to evaluate the effect of multiple funding levels on the overall future pavement condition. This output was further used to develop the PCIP. Figure 4.3 illustrates the process that PAVER uses in the funding analysis.

The following M&R funding levels were used for the GZH pavement network to help establish the 7-Year PCIP. Figure 4.4 presents the network area-weighted average PCI for each of the following funding scenarios at the end of the analysis period:

- Unlimited Funding: Unlimited funding is available for all pavement needs. The PCI increases to 88 by 2027.
- Maintain PCI: Maintain existing PCI of 42.
- Constrained Funding: This scenario constrains the funding to \$1 million each year (total of \$7 million). The PCI remains unchanged at 47 in 2027.
- Do Nothing: Performing no M&R would reduce the network PCI from 47 to 22 by 2027.

Figure 4.3: Budget Analysis Process.

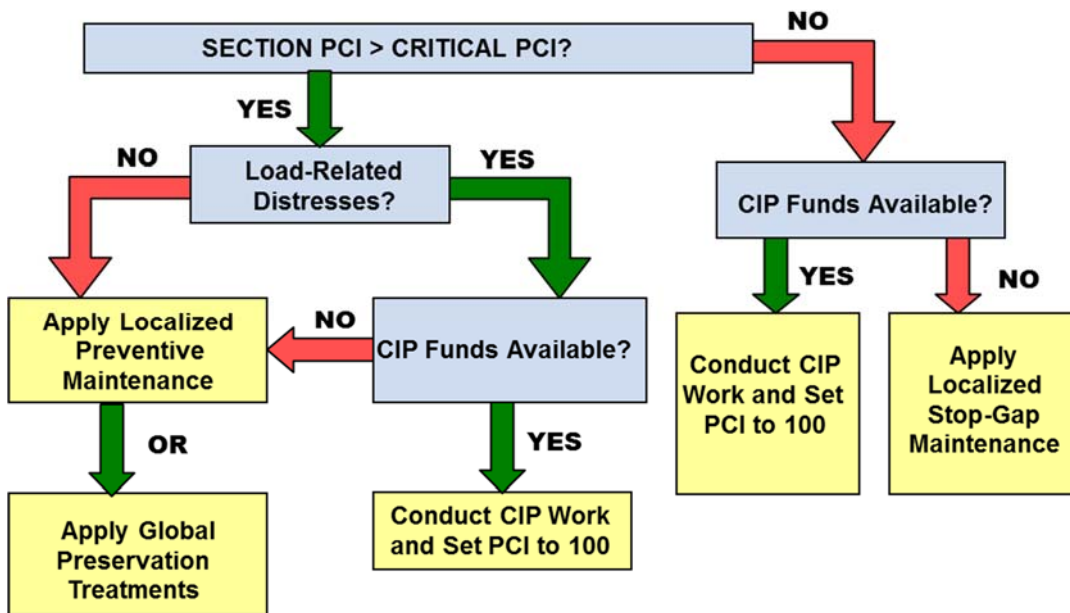


Figure 4.4: M&R Funding Levels.

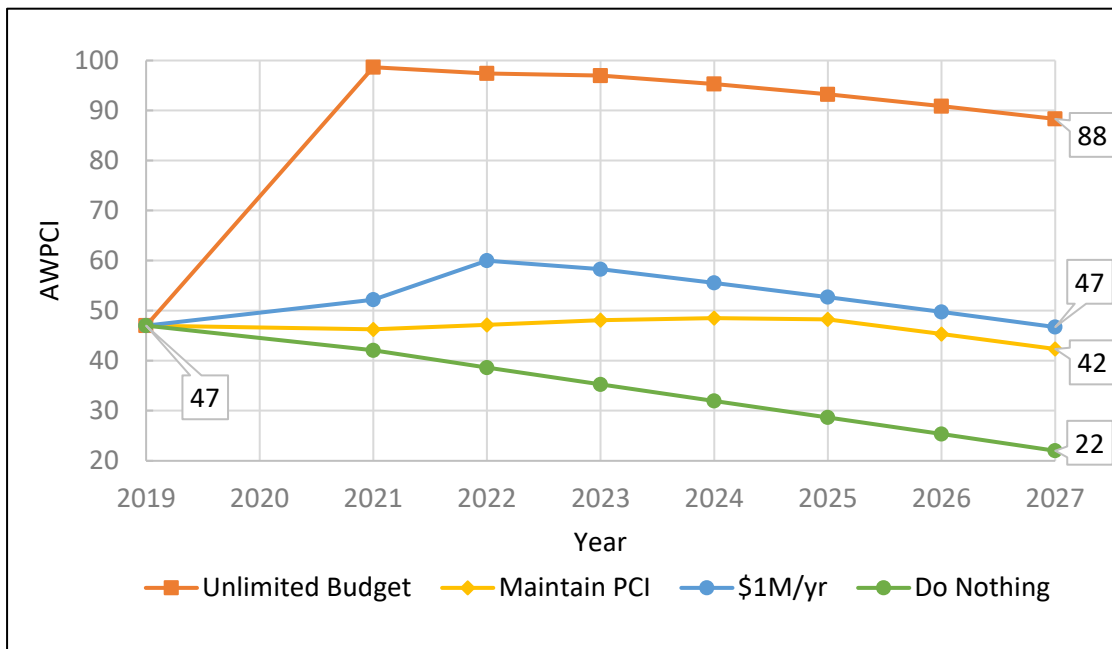


Table 4.2 summarizes the annual funding required for the above analyses. For the unlimited analysis, all pavement needs are funded in the year they are required. Therefore, the unfunded costs are zero. The total funded amount over the 7-year period is approximately \$5.1 million. For the annual funding level of \$1 million per year, funding is prioritized based on the prioritization matrix. When the needs exceed the funding for any year, the remaining sections are transferred to the succeeding year and the amount



for these activities are represented as “unfunded”. The “unfunded” repairs in 2027 for this funding level is approximately \$4 million.

Table 4.2: Summary of M&R Funding Level Analyses.

Year	Unlimited	Maintain PCI	Constrained \$1M/year	Do Nothing
2021	\$5,041,000	\$427,000	\$970,000	\$0
2022	\$2,000	\$452,000	\$948,000	\$0
2023	\$66,000	\$401,000	\$144,000	\$0
2024	\$3,000	\$385,000	\$88,000	\$0
2025	\$5,000	\$415,000	\$100,000	\$0
2026	\$7,000	\$149,000	\$134,000	\$0
2027	\$9,000	\$191,000	\$171,000	\$0
Total	\$5,131,000	\$2,419,000	\$2,555,000	\$0
2027 Backlog	-	\$4,428,000	\$3,961,000	\$6,556,000

Map B3A in Appendix B presents the 2027 forecasted PCI by section when the M&R activities recommended in the CIP are not conducted.

4.6. Pavement Capital Improvement Program

The unlimited funding analysis contains rehabilitation activities for sections from the same branch spread out over the seven-year period, which is not always operationally feasible to construct. The analysis output was treated as a starting point in developing the CIP. Sections were often integrated together to account for construction feasibility and other factors, resulting in larger projects which were more realistic. In addition, each project could contain sections whose condition did not trigger rehabilitation but were included to provide a logical plan which would avoid creating “islands” of newer pavement within a particular feature. For example, if the PAVER analysis showed rehabilitation was required for eight out of 10 sections on a runway, the entire runway would be recommended for rehabilitation to provide a continuous new pavement surface.

Table 4.3 shows the projects and the associated costs for the recommended 7-year PCIP. As directed by ALDOT, Runways 01-19 and 10-28 were excluded from the PCIP. Table 4.4 is a more detailed view of the PCIP. This table lists the individual pavement section, section level M&R work, section repair cost, surface area and the PCI before the M&R is applied. The costs that are presented represent an annual escalation rate of 3% for the unit costs. The total 7-year PCIP cost is approximately \$5.8 million. Map B3B shows the recommended repair types, while Map B3C presents the recommended projects and activities in the PCIP. Appendix I1 presents a summary of the recommended activities and cost by year for each section at GZH.



Table 4.3: Summary of 7-Year PCIP by Project.

Project Year	CIP Project	Total Project Cost	Total Project Area, sf	AWPCI Before	AWPCI After
2021	GZH_21-01_Taxiway Parallel 01 Rehabilitation	\$2,383,448	298,199	55	99
2022	GZH_22-01_Taxiway Hangar Rehabilitation	\$305,187	60,347	54	100
2023	GZH_23-01_Taxiway Parallel 02 Reconstruction	\$2,738,104	253,769	26	100
2024	GZH_24-01_Taxiway Parallel 01 Surface Treatment	\$145,316	228,330	96	99
2025	GZH_25-01_Apron 01 Surface Treatment	\$21,603	32,955	94	98
2026	GZH_26-01_Taxiway Parallel 02 Surface Treatment	\$171,342	253,769	96	99
Total		\$5,765,000			

Table 4.4: Summary of 7-Year PCIP by Project and Section.

Branch	Section	Area, sf	PCI Before Rehab	Activity	Activity Type	Cost
GZH_21-01_Taxiway Parallel 01 Rehabilitation						\$2,383,448
TC01	01	13,778	35	AC Reconstruction	Reconstruction	\$140,127
TP01	01	69,869	89	Taxiway & Apron Surface Treatment	Preservation	\$61,246
TP01	02	158,755	36	AC Reconstruction	Reconstruction	\$1,614,598
TP01	03	16,126	34	AC Reconstruction	Reconstruction	\$164,007
TP01	04	39,671	35	AC Reconstruction	Reconstruction	\$403,469
R0119	01	150,000	72	Mill 2" & 2" AC OL	Rehabilitation	See Note
GZH_22-01_Taxiway Hangar Rehabilitation						\$305,187
A01	01	20,590	61	Mill 2" & 2" AC OL	Rehabilitation	\$93,243
T02	01	12,365	56	Mill 2" & 2" AC OL	Rehabilitation	\$55,996
THANG01	01	27,392	50	Mill 2" & 2" AC OLP	Rehabilitation	\$155,948
GZH_23-01_Taxiway Parallel 02 Reconstruction						\$2,738,104
T01	01	26,437	25	AC Reconstruction	Reconstruction	\$285,249
TC02	01	13,598	26	AC Reconstruction	Reconstruction	\$146,719
TP02	01	21,793	26	AC Reconstruction	Reconstruction	\$235,141
TP02	02	14,632	28	AC Reconstruction	Reconstruction	\$157,876
TP02	03	177,309	28	AC Reconstruction	Reconstruction	\$1,913,120
GZH_24-01_Taxiway Parallel 01 Surface Treatment						\$145,316
TC01	01	13,778	-	Surface Treatment	Preservation	\$8,769
TP01	02	158,755	-	Surface Treatment	Preservation	\$101,037
TP01	03	16,126	-	Surface Treatment	Preservation	\$10,263
TP01	04	39,671	-	Surface Treatment	Preservation	\$25,248
GZH_25-01_Apron 01 Surface Treatment						\$21,603
A01	01	20,590	-	Surface Treatment	Preservation	\$13,497
T02	01	12,365	-	Surface Treatment	Preservation	\$8,106
GZH_26-01_Taxiway Parallel 02 Surface Treatment						\$171,342



Branch	Section	Area, sf	PCI Before Rehab	Activity	Activity Type	Cost
T01	01	26,437	-	Surface Treatment	Preservation	\$17,850
TC02	01	13,598	-	Surface Treatment	Preservation	\$9,181
TP02	01	21,793	-	Surface Treatment	Preservation	\$14,714
TP02	02	14,632	-	Surface Treatment	Preservation	\$9,879
TP02	03	177,309	-	Surface Treatment	Preservation	\$119,717
Total						\$5,765,000

Cost for section R0119-01 excluded from PCIP as directed by ALDOT

The FAA, under the Airport Improvement Program (AIP) provides approximately 90 percent of eligible costs for planning and development of public-use airports included in the NPIAS as grants. The remaining 10 percent of costs are shared between ALDOT and the airport sponsor. The following is the distribution of the 7-yr PCIP cost of \$5.8 million for GZH:

- FAA (90%): \$5.2 million
- ALDOT (5%): \$0.3 million
- Airport Sponsor (5%): \$0.3 million

The recommendations within the PCIP are based on a network-level study and should be used for planning purposes only. A detailed project-level assessment should be conducted for each project to determine the appropriate repair activities and develop more accurate cost estimates.

Table 4.5 summarizes the maintenance activities that are recommended for Year 1 (2021). The estimated cost is approximately \$9,043. A complete listing of the maintenance activities by section is presented in Appendix I2. This may be used as a basis for establishing an annual maintenance budget for the GZH pavements.

Table 4.5: Summary of Year-1 Maintenance Plan.

Policy	Work Description	Work Quantity	Work Unit	Work Cost
Preventive	Crack Sealing - AC	614	Ft	\$2,426
	Patching - AC Full-Depth	259	SqFt	\$6,479
Safety	Crack Sealing - AC	35	Ft	\$138
Total				\$9,043

APPENDIX A
INVENTORY



Appendix A
Pavement Inventory Report
Evergreen Regional - Middleton Field (GZH)

Branch ID	Name	Branch Use	Section ID	Rank ¹	Length (ft)	Width (ft)	Area (sf)	LCD ²	Surface ³
A01	Apron 01 Evergreen	APRON	01	S	150	153	20,590	1/1/2003	AC
R0119	Runway 01-19 Evergreen	RUNWAY	01	P	1,000	150	150,000	1/1/2011	AC
R0119	Runway 01-19 Evergreen	RUNWAY	02	P	2,975	150	446,250	1/1/2003	AC
R0119	Runway 01-19 Evergreen	RUNWAY	03	P	885	150	132,750	1/1/2003	AC
R1028	Runway 10-28 Evergreen	RUNWAY	01	P	4,004	150	600,600	1/1/2003	AC
R1028	Runway 10-28 Evergreen	RUNWAY	02	P	1,000	150	150,000	1/1/2013	AC
T01	Taxiway 01 Evergreen	TAXIWAY	01	S	448	50	26,437	1/1/2003	AC
T02	Taxiway 02 Evergreen	TAXIWAY	01	S	195	30	12,365	1/1/1945	AC
TC01	Taxiway Connector 01 Evergreen	TAXIWAY	01	S	245	50	13,778	1/1/2003	AC
TC02	Taxiway Connector 02 Evergreen	TAXIWAY	01	S	255	50	13,598	1/1/1945	AC
THANG01	Taxiway Hangar 01 Evergreen	TAXIWAY	01	T	160	135	27,392	1/1/1945	AC
TP01	Taxiway Parallel 01 Evergreen	TAXIWAY	01	P	1,285	50	69,869	10/2/2016	AC
TP01	Taxiway Parallel 01 Evergreen	TAXIWAY	02	P	3,120	50	158,755	1/1/2003	AC
TP01	Taxiway Parallel 01 Evergreen	TAXIWAY	03	P	255	50	16,126	1/1/2003	AC
TP01	Taxiway Parallel 01 Evergreen	TAXIWAY	04	P	790	50	39,671	1/1/2003	AC
TP02	Taxiway Parallel 02 Evergreen	TAXIWAY	01	P	403	50	21,793	1/1/1945	AC
TP02	Taxiway Parallel 02 Evergreen	TAXIWAY	02	P	250	50	14,632	1/1/1945	AC
TP02	Taxiway Parallel 02 Evergreen	TAXIWAY	03	P	3,500	50	177,309	1/1/1945	AC

¹ P = Primary pavement, S = Secondary pavement, T = Tertiary pavement

² LCD = Last construction date. The date of the last major pavement rehabilitation (e.g. AC overlay)

³ AC = Asphalt Cement Concrete, AAC = Asphalt Overlay AC, PCC = Portland cement Concrete, APC = Asphalt Overlay PCC

APPENDIX B

PMP Maps

B1: Inventory Maps

B1A: Branch Identification

B1B: Section Identification

B1C: Sample Unit Layout

B1D: Pavement Type

B1E: Branch Use

B1F: Pavement Age

B2: Surface Condition Maps

B2A: 7-Color PCI

B2B: 3-Color PCI

B2C: FOD Rating

B2D: Survey Photo Locations

B3: Pavement Capital Improvement Plan (PCIP) Maps

B3A: 2027 Forecasted PCI without PCIP

B3B: M&R Needs

B3C: PCIP Recommendations

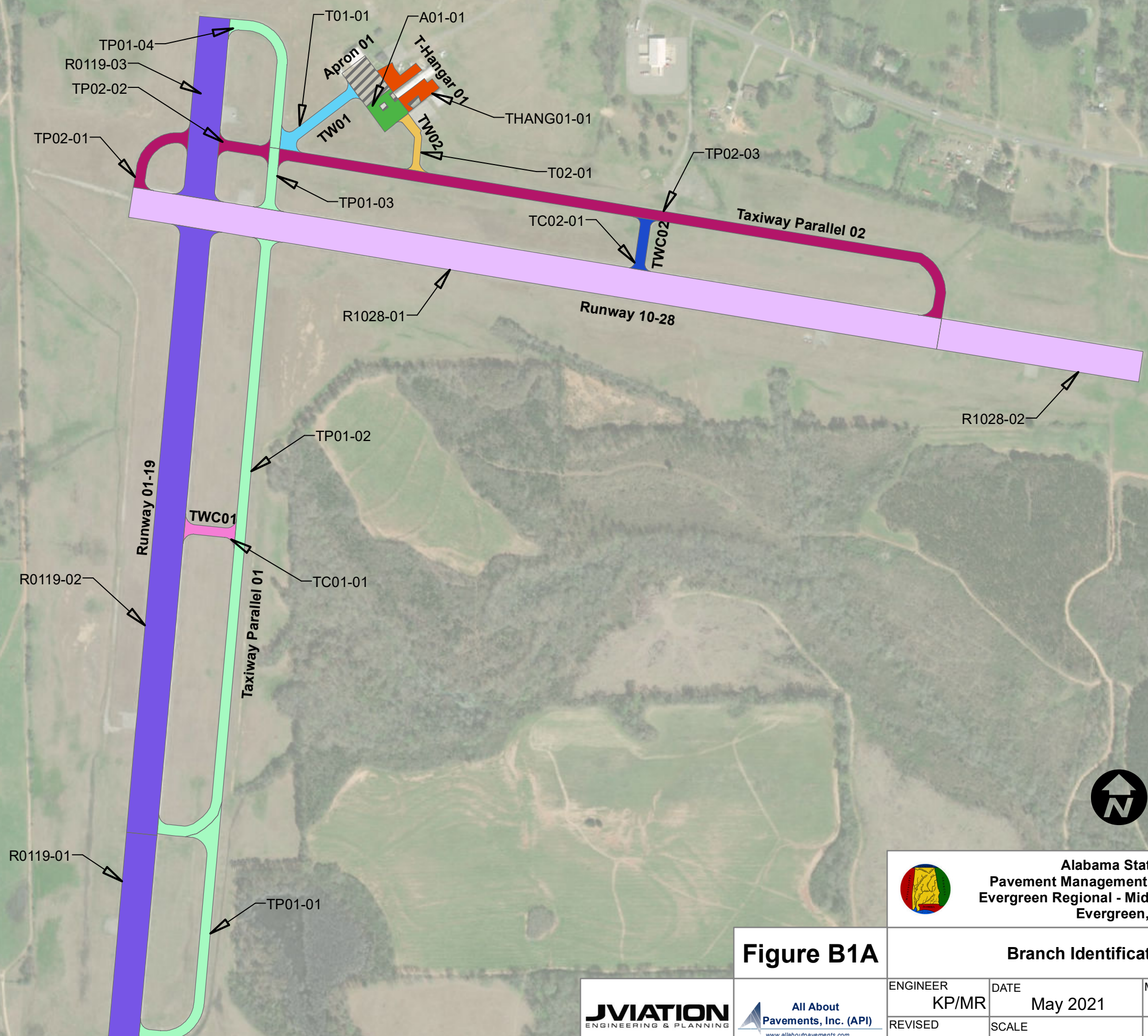
Legend

Section Boundary

PCC Aprons

Branch Identification

- Apron 01 Evergreen
- Runway 01-19 Evergreen
- Runway 10-28 Evergreen
- Taxiway 01 Evergreen
- Taxiway 02 Evergreen
- Taxiway Connector 01 Evergreen
- Taxiway Connector 02 Evergreen
- Taxiway Hangar 01 Evergreen
- Taxiway Parallel 01 Evergreen
- Taxiway Parallel 02 Evergreen



Alabama Statewide
 Pavement Management Program Update
 Evergreen Regional - Middleton Field (GZH)
 Evergreen, AL

Figure B1A

Branch Identification		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 1
REVISED JMA	SCALE 1 in = 500 ft	FINAL



Legend

- Section Boundary
- PCC Aprons

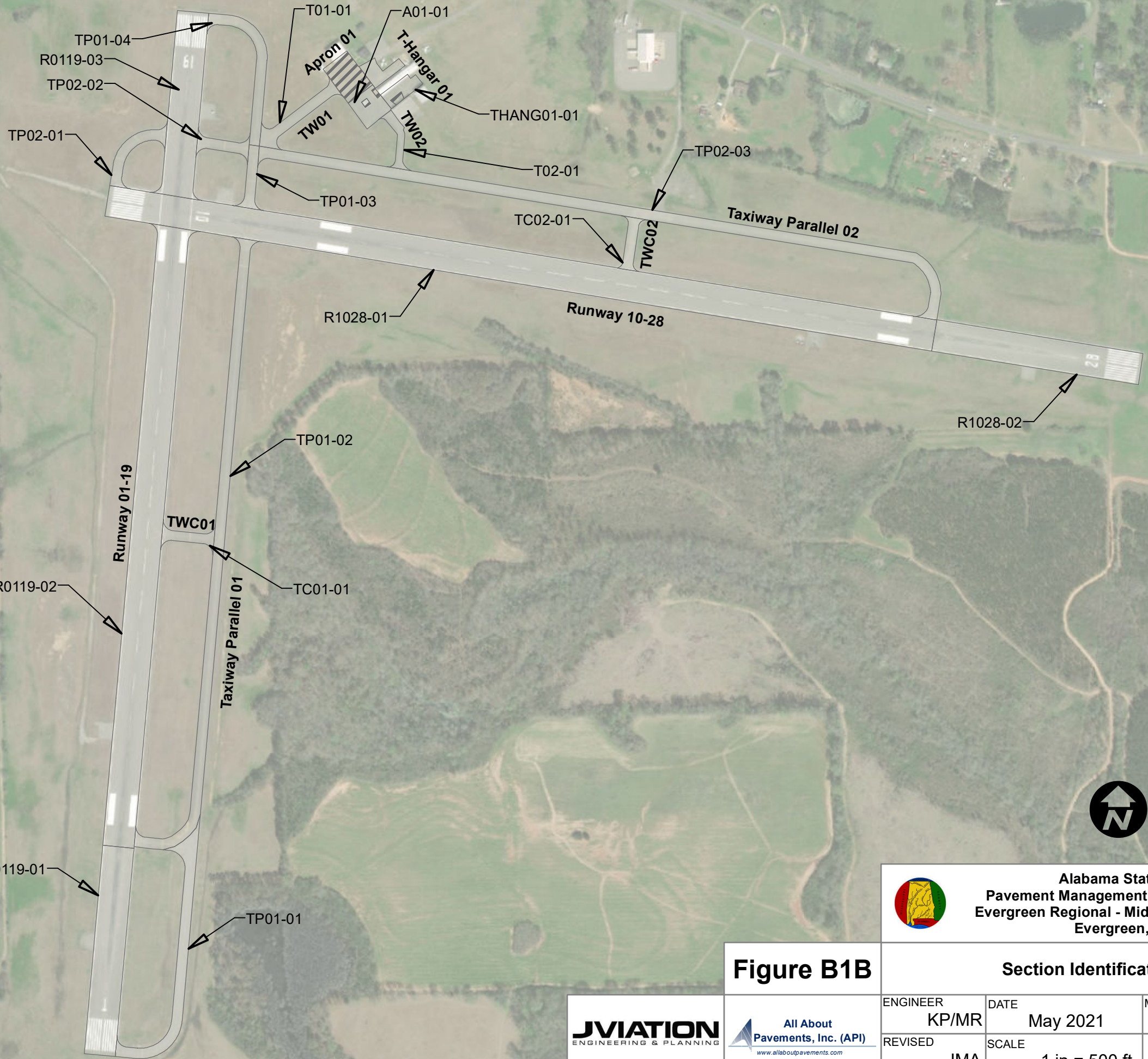




Figure B1B

Alabama Statewide
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 Evergreen Regional - Middleton Field (GZH)
 Evergreen, AL



Section Identification		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 2
REVISED JMA	SCALE 1 in = 500 ft	FINAL



Legend

-  Section Boundary
-  PCC Aprons

Sample Unit Layout

-  SU Boundary
-  Inspected

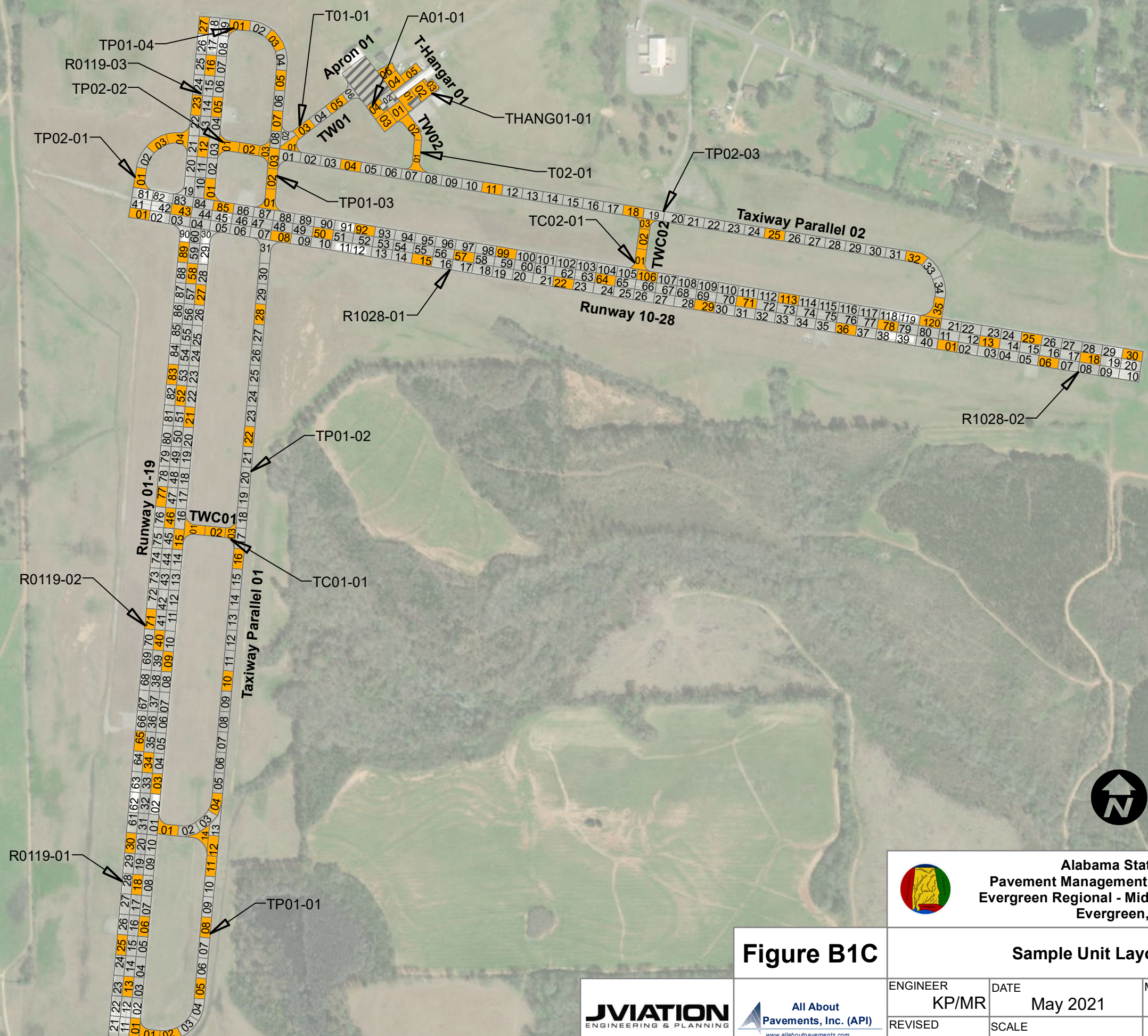


Figure B1C

Alabama Statewide
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 Evergreen Regional - Middleton Field (GZH)
 Evergreen, AL




Sample Unit Layout

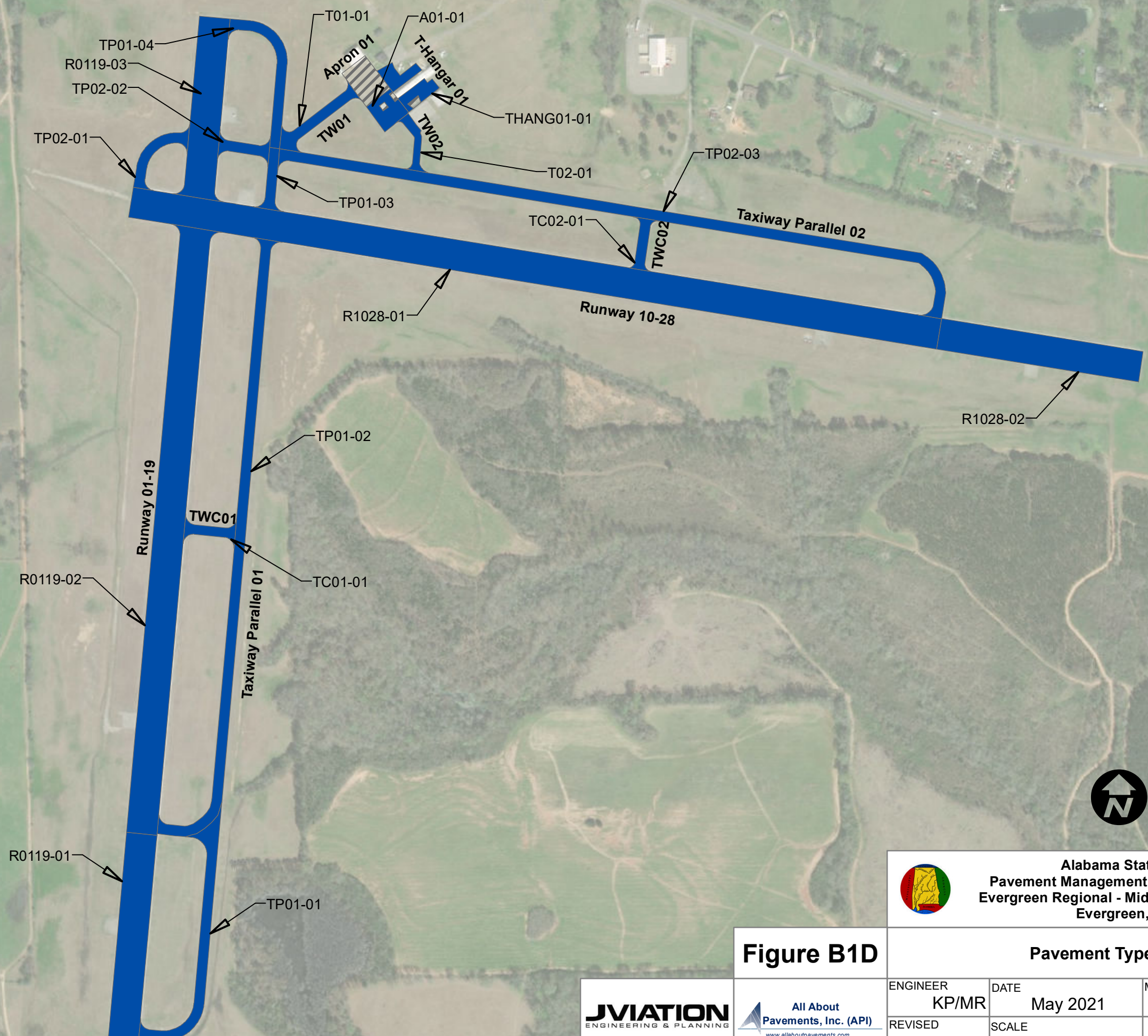
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 3
REVISED JMA	SCALE 1 in = 500 ft	FINAL

JVIATION
 ENGINEERING & PLANNING

All About
 Pavements, Inc. (API)
 www.allaboutpavements.com
 Telephone: 217-586-2765 FAX: 217-586-1967

Legend

-  Section Boundary
-  PCC Aprons
- Pavement Type**
-  Asphalt Concrete (AC)




**Alabama Statewide
Pavement Management Program Update
Evergreen Regional - Middleton Field (GZH)
Evergreen, AL**



Figure B1D






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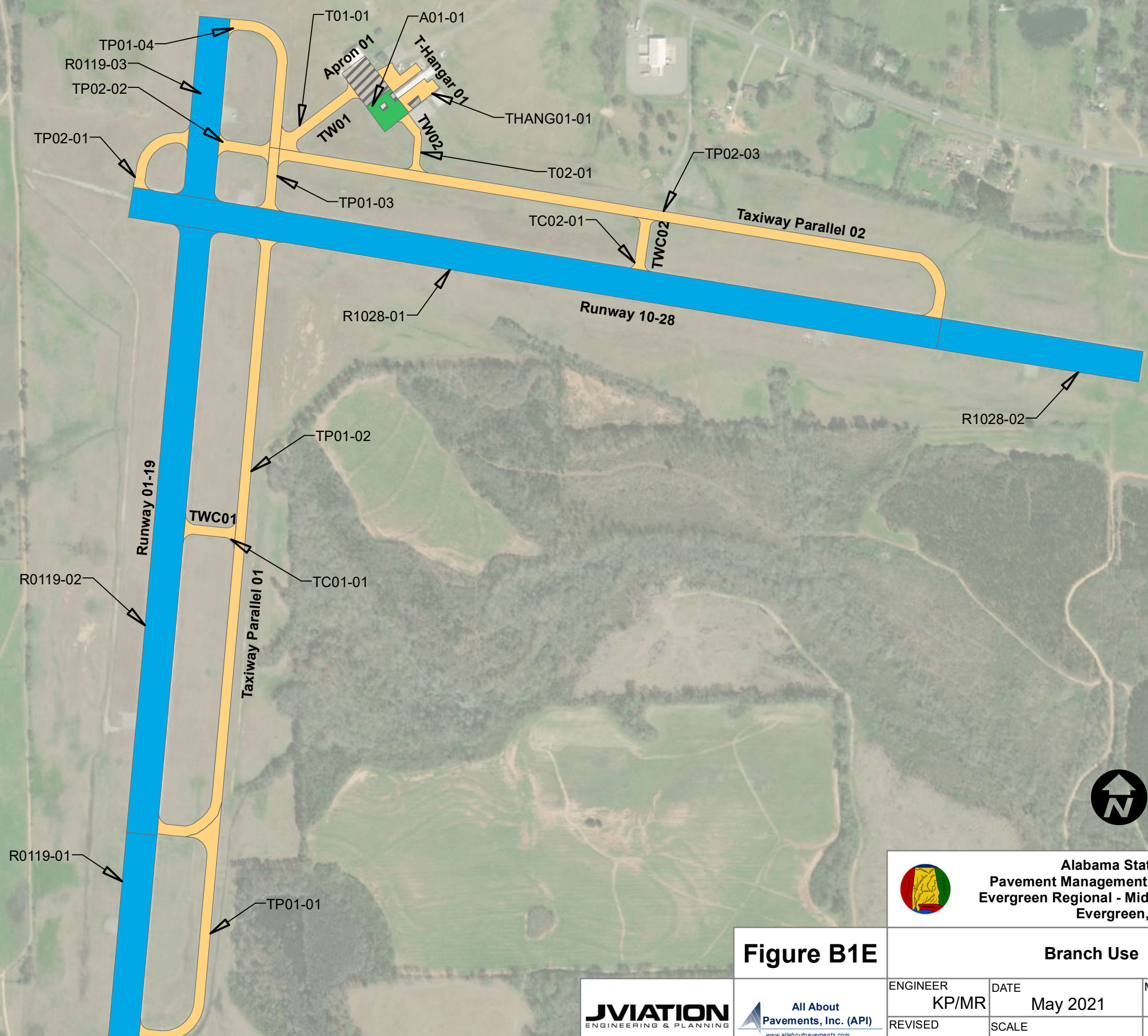
Pavement Type		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 4
REVISED JMA	SCALE 1 in = 500 ft	FINAL

Legend

-  Section Boundary
-  PCC Aprons

Branch Use

-  APRON
-  RUNWAY
-  TAXIWAY



 **Alabama Statewide
Pavement Management Program Update
Evergreen Regional - Middleton Field (GZH)
Evergreen, AL**

Figure B1E



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Branch Use		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 5
REVISED JMA	SCALE 1 in = 500 ft	FINAL

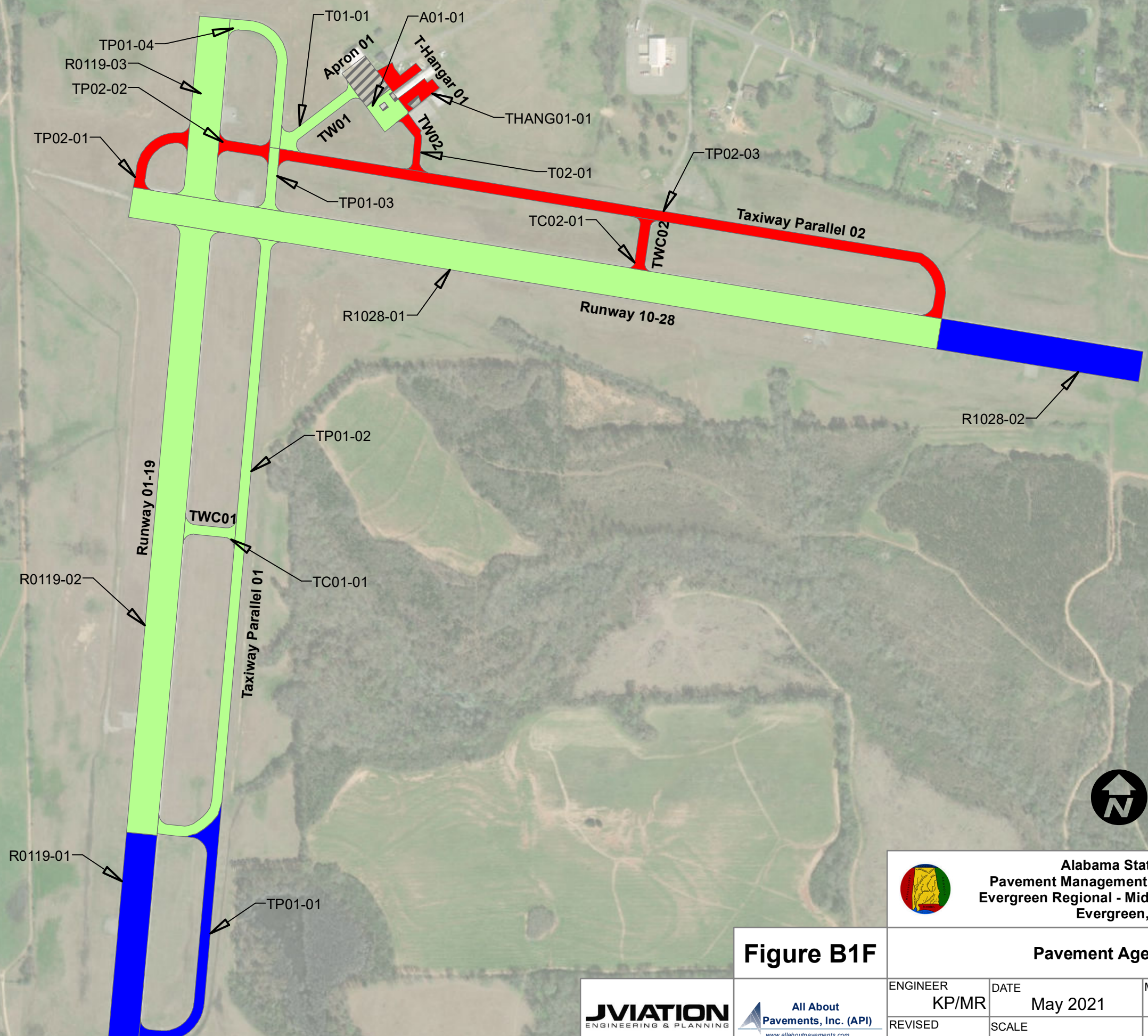
Legend

Section Boundary

PCC Aprons

Pavement Age (Yrs)

- 0 - 10
- 11 - 15
- 16 - 25
- 26 - 50
- >50



Alabama Statewide
 Pavement Management Program Update
 Evergreen Regional - Middleton Field (GZH)
 Evergreen, AL










Figure B1F

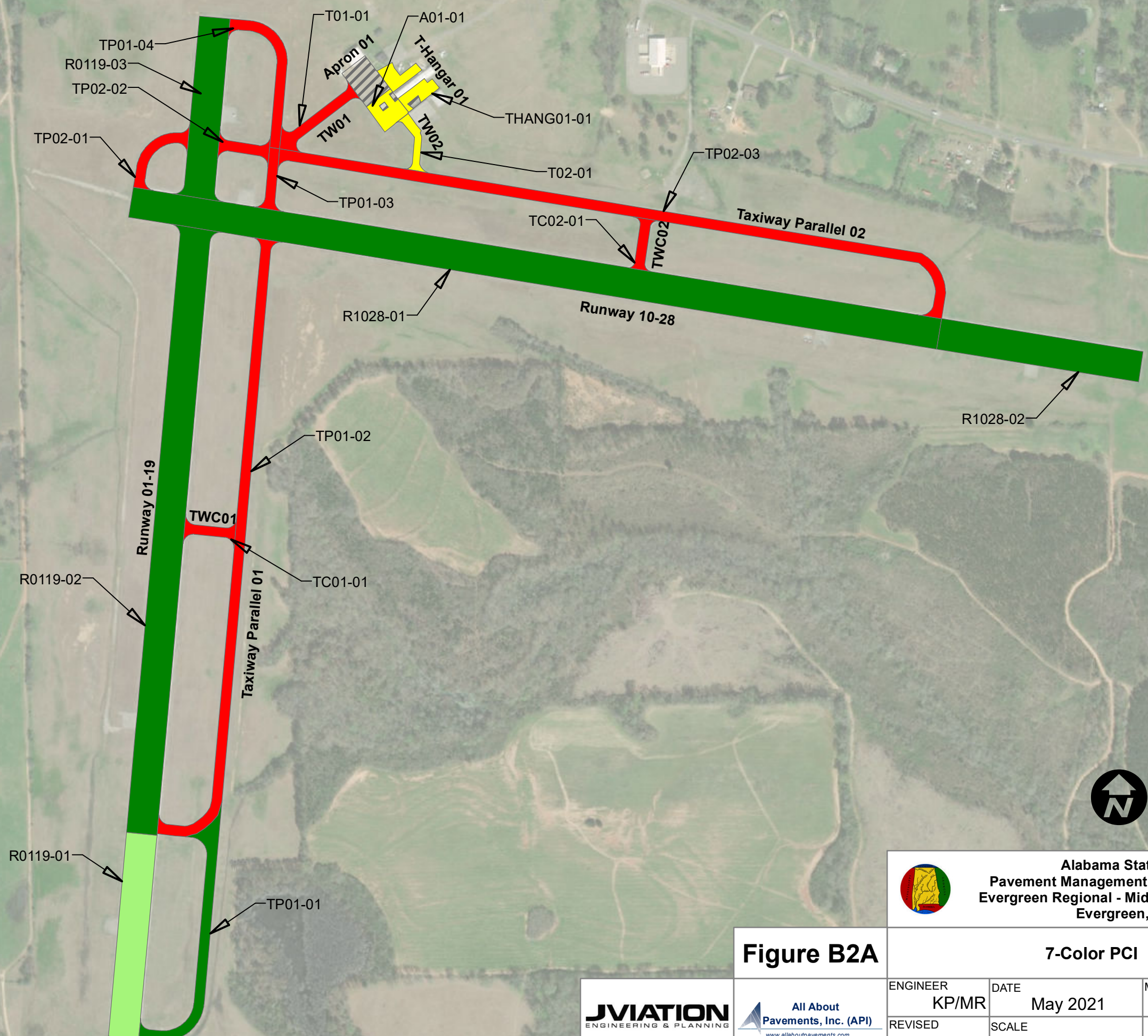


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Pavement Age		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 6
REVISED JMA	SCALE 1 in = 500 ft	FINAL

Legend

-  Section Boundary
-  PCC Aprons
- PCI (7 Color)**
-  Good (86-100)
-  Satisfactory (71-85)
-  Fair (56-70)
-  Poor (41-55)
-  Very Poor (26-40)
-  Serious (11-25)
-  Failed (0-10)




**Alabama Statewide
Pavement Management Program Update
Evergreen Regional - Middleton Field (GZH)
Evergreen, AL**






Figure B2A

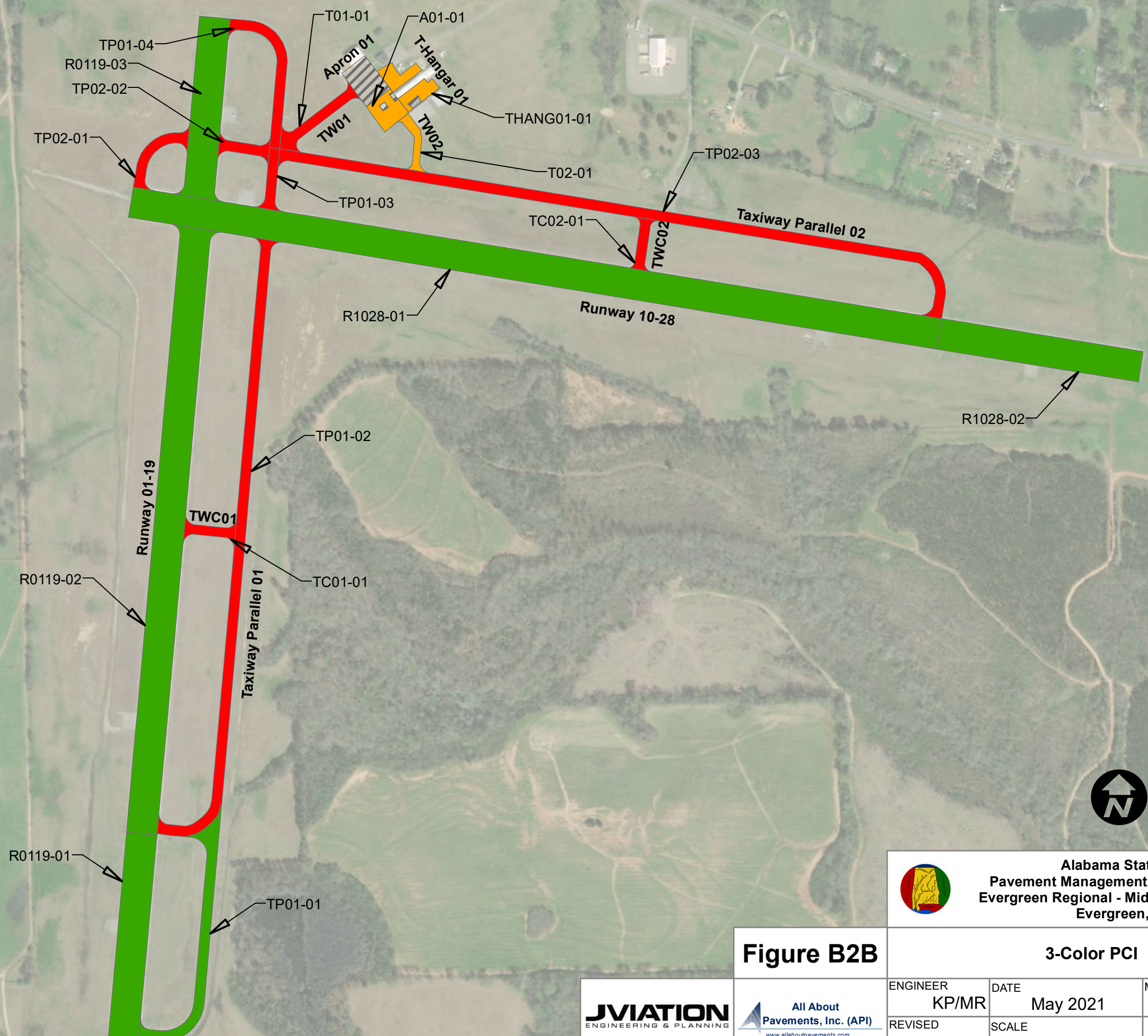
7-Color PCI		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 7
REVISED JMA	SCALE 1 in = 500 ft	FINAL


JVIATION
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Legend

-  Section Boundary
-  PCC Aprons
- PCI (3 Color)**
-  Good (71-100)
-  Fair (56-70)
-  Poor (0-55)





Alabama Statewide
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 Evergreen Regional - Middleton Field (GZH)
 Evergreen, AL

Figure B2B




3-Color PCI		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 8
REVISED JMA	SCALE 1 in = 500 ft	FINAL

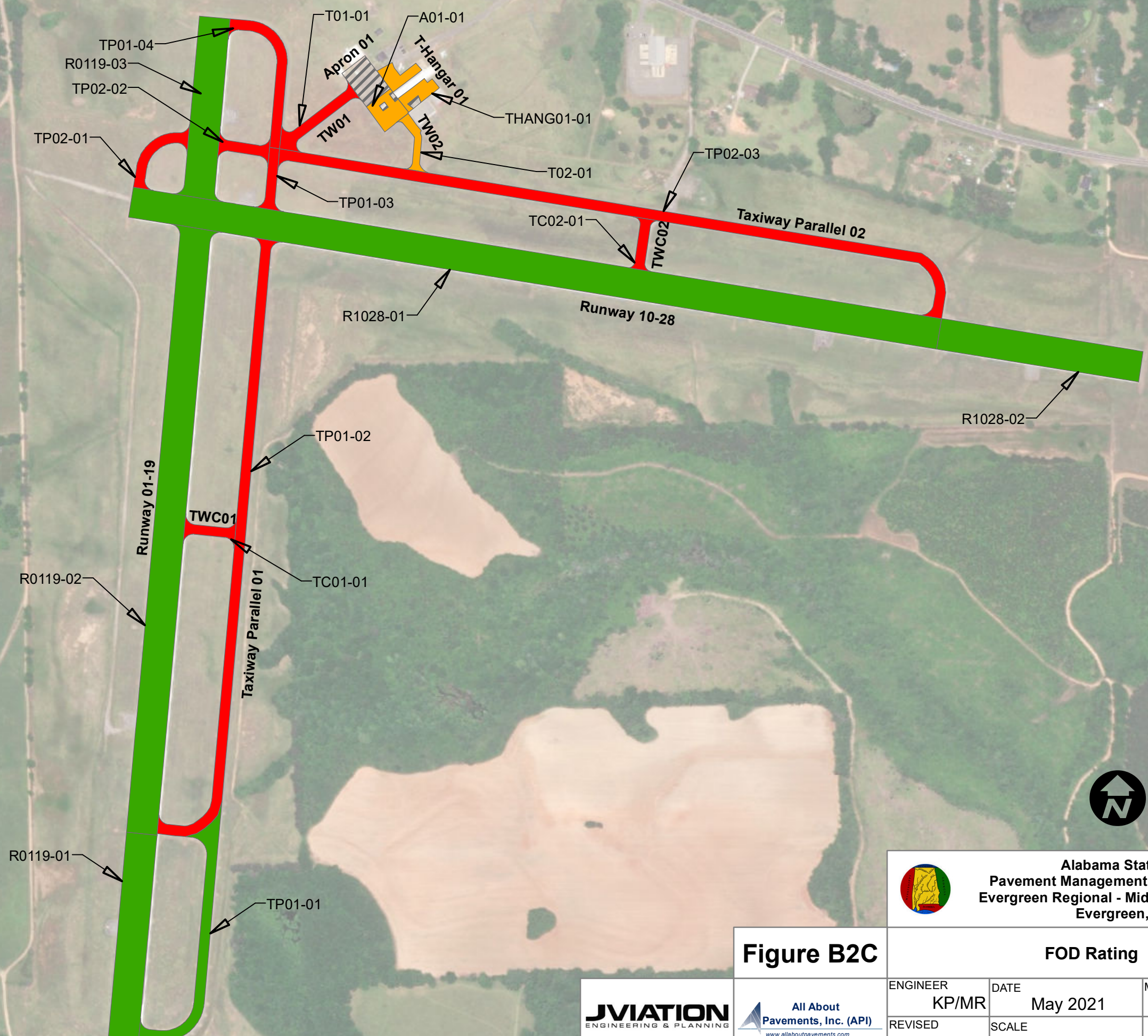


Legend

-  Section Boundary
-  PCC Aprons

FOD Rating

-  Good (0 - 45)
-  Fair (46 - 60)
-  Poor (61 - 100)






Alabama Statewide
 Pavement Management Program Update
 Evergreen Regional - Middleton Field (GZH)
 Evergreen, AL

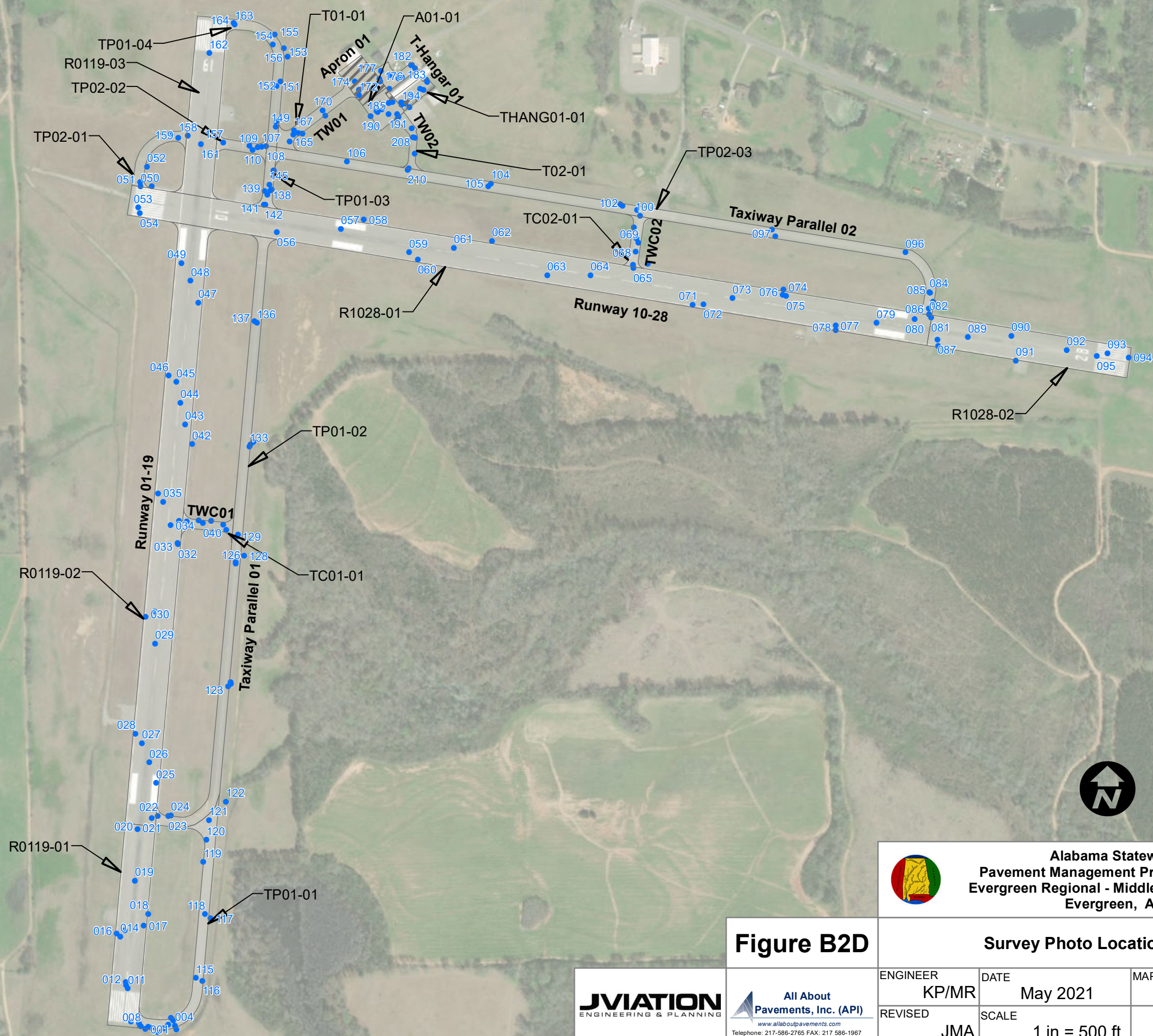
Figure B2C

FOD Rating		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 9
REVISED JMA	SCALE 1 in = 500 ft	FINAL



Legend

-  Section Boundary
-  PCC Aprons
-  Survey Photo Locations





 **Alabama Statewide
Pavement Management Program Update
Evergreen Regional - Middleton Field (GZH)
Evergreen, AL**

Figure B2D








Survey Photo Locations		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 10
REVISED JMA	SCALE 1 in = 500 ft	FINAL

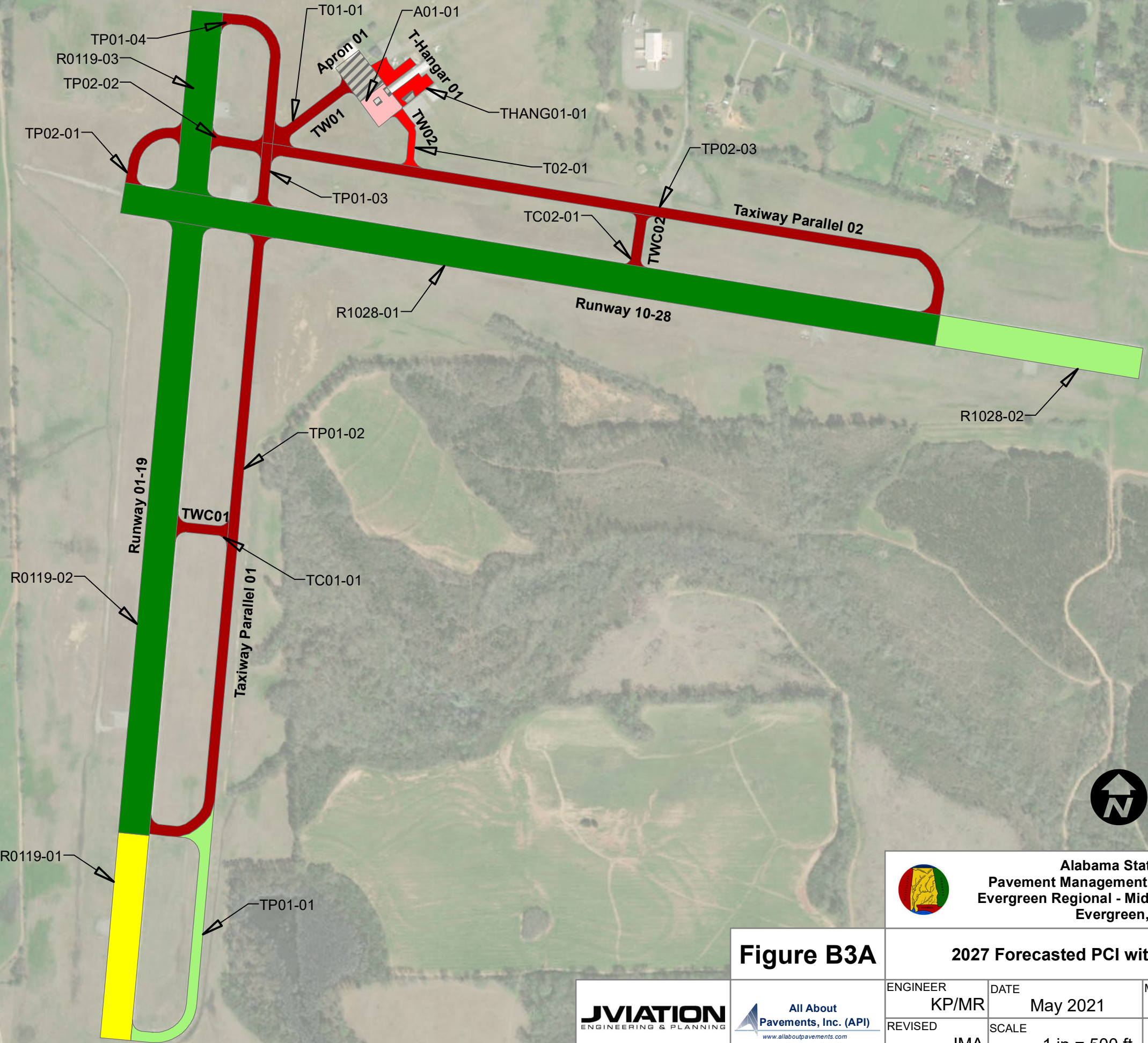


Legend

-  Section Boundary
-  PCC Aprons

Forecasted PCI without PCIP

-  Good (86-100)
-  Satisfactory (71-85)
-  Fair (56-70)
-  Poor (41-55)
-  Very Poor (26-40)
-  Serious (11-25)
-  Failed (0-10)



Alabama Statewide
 Pavement Management Program Update
 Evergreen Regional - Middleton Field (GZH)
 Evergreen, AL

Figure B3A

2027 Forecasted PCI without PCIP



ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 11
REVISED JMA	SCALE 1 in = 500 ft	FINAL

All sections recommended for Rehabilitation or Reconstruction between 2021 and 2024 also receive Surface Treatment in the 3rd year of paving.

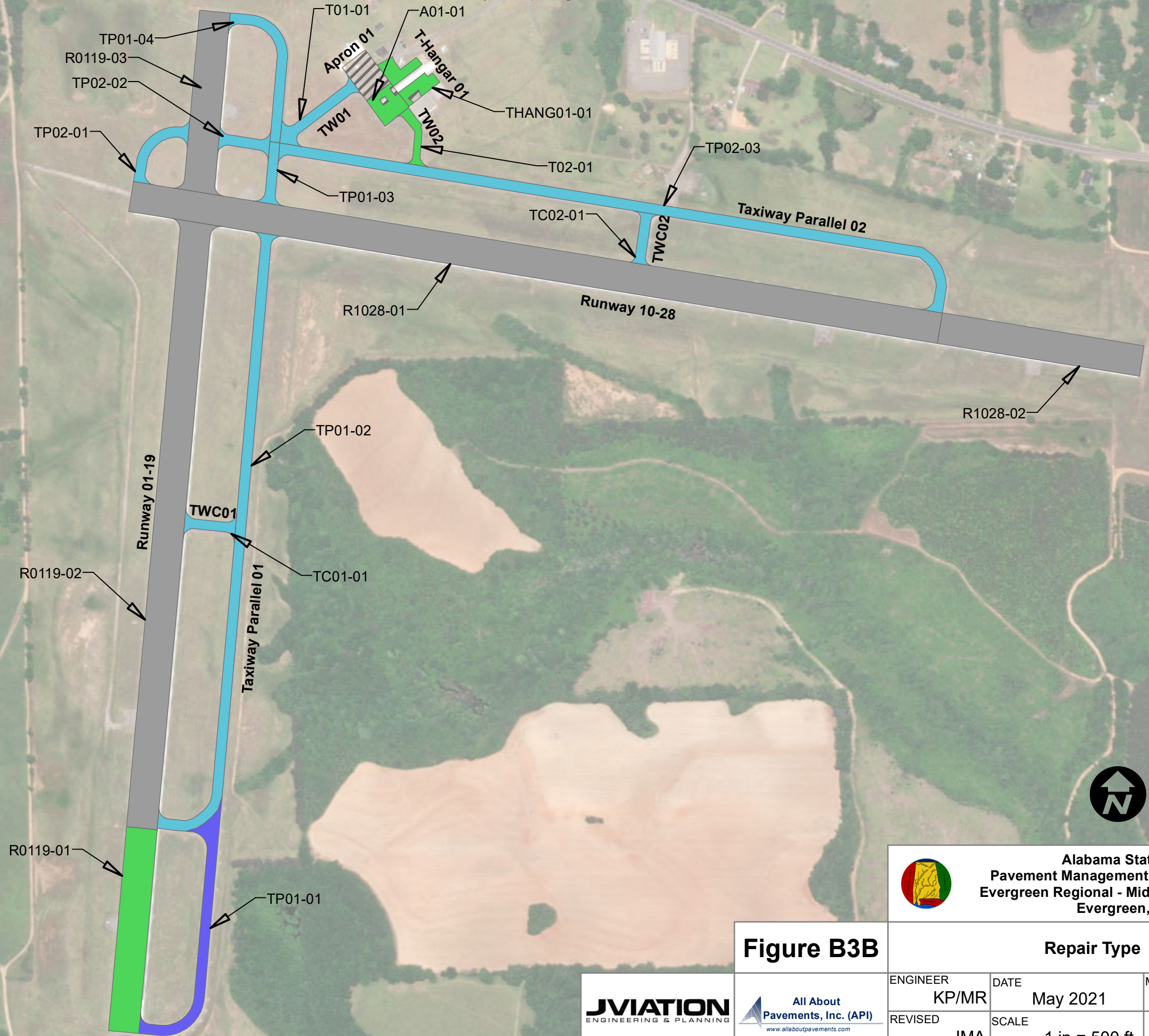
Legend

Section Boundary

PCC Aprons

Repair Type

- No Activity
- Preservation
- Reconstruction
- Rehabilitation



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 Evergreen, AL

Figure B3B



All About Pavements, Inc. (API)
 www.allaboutpavements.com
 Telephone: 217-586-2765 FAX: 217-586-1967

Repair Type		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 12
REVISED JMA	SCALE 1 in = 500 ft	FINAL

All sections recommended for Mill & AC Overlay or AC Reconstruction between 2021 and 2024 also receive Surface Treatment in the 3rd year of paving

Legend

Project Name

- GZH_21-01_Taxiway Parallel 01 Rehabilitation
- GZH_22-01_Taxiway Hangar Rehabilitation
- GZH_23-01_Taxiway Parallel 02 Reconstruction
- No Project

M&R Activity

- AC Reconstruction
- Mill 2" & 2" AC OL
- Mill 2" & 2" AC OLP
- Taxiway & Apron Surface Treatment
- No Activity

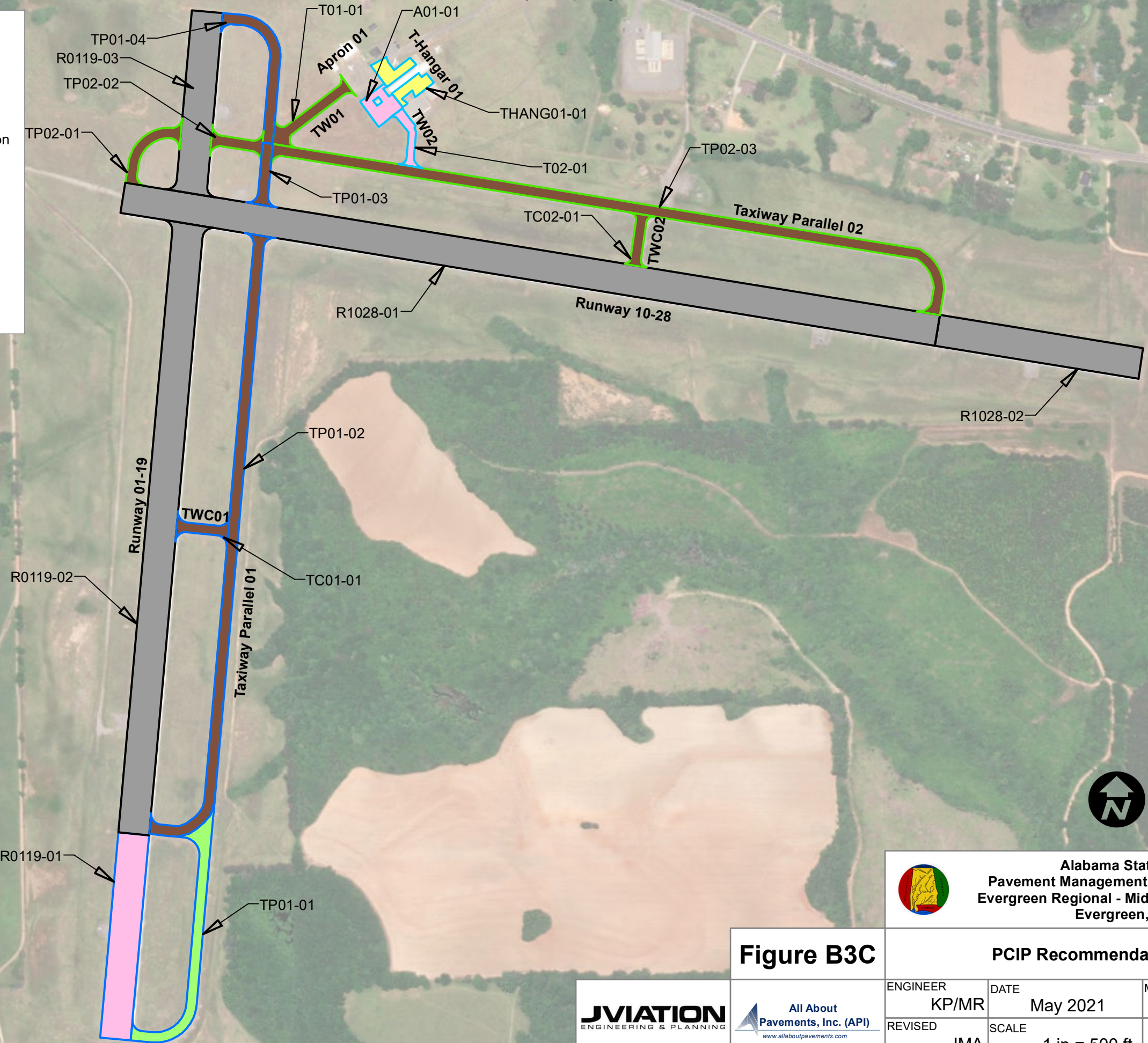


Figure B3C

**Alabama Statewide
Pavement Management Program Update
Evergreen Regional - Middleton Field (GZH)
Evergreen, AL**

PCIP Recommendations		
ENGINEER KP/MR	DATE May 2021	MAP NUMBER Page 13
REVISED JMA	SCALE 1 in = 500 ft	FINAL



APPENDIX C

OVERVIEW OF PAVEMENT DISTRESSES



1. Alligator Cracking (AC)

Alligator cracking is a series of interconnecting cracks caused by fatigue failure of the asphalt concrete surface where tensile stress and strain is highest under wheel loads. The cracks propagate to the surface initially as a series of parallel cracks. After repeated traffic loading the cracks connect, forming many sided, sharp angled pieces that develop a pattern resembling chicken wire or the skin of an alligator. The pieces are less than 2 feet long on the longest side. Alligator cracking occurs only in areas that are subjected to repeated traffic loading, such as wheel paths, and is considered a major structural distress.

Severities:

- ◆ Low - made up of fine, hair-like cracks running parallel to each other with none or only a few inter-connecting cracks. The cracks are not spalled;
- ◆ Medium - Further development of light alligator cracking into a pattern or network of cracks that may be lightly spalled. Medium-severity alligator cracking is defined by a well-defined pattern of interconnecting cracks, where all pieces are securely held in place (good aggregate interlock between pieces);
- ◆ High - has progressed so that the pieces are well defined and spalled at the edges. Some of the pieces may rock under traffic and may cause FOD potential.

Repair options:

- ◆ Low - No action, surface seal or overlay for low severity distress;
- ◆ Medium - partial or full depth patch, overlay or reconstruct;
- ◆ High - partial or full depth patch, overlay or reconstruct.



2. Bleeding (AC)

Bleeding is a film of bituminous material on the pavement surface that creates a shiny, glass-like, reflecting surface that usually becomes quite sticky. Bleeding is caused by excessive amounts of asphaltic cement or tars in the mix or low-air void content, or both. It occurs when asphalt fills the voids of the mix during hot weather and then expands out onto the surface of the pavement. Since the bleeding process is not reversible during cold weather, asphalt or tar will accumulate on the surface.

Severities: No degrees of severity are defined. Bleeding should be noted when it is extensive enough to reduce skid resistance.

Repair Policies: Do nothing; sand blot the distressed area by applying heat and roll sand into the areas affected with bleeding, remove the excess material; patch.



3. Block Cracking (AC)

Block cracks are interconnected cracks that divide the pavement into rectangular shaped pieces. The blocks may range in size from 1 by 1 foot to 10 by 10 feet. Block cracking is caused mainly by shrinkage of the asphalt concrete and is not load associated. The occurrence of block cracking usually indicates that the asphalt has hardened significantly. Block cracking normally occurs over a large proportion of the pavement area, but will sometimes occur only in the non-traffic areas.

Severities:

- ◆ Low - defined by cracks that are at most lightly spalled, causing no foreign object damage (FOD) potential. Un-filled cracks have 1/4 inch or less mean width, and filled cracks have filler in satisfactory condition;
- ◆ Medium - defined by cracks that are moderately spalled (some FOD potential), un-filled cracks that are at most lightly spalled, but have a mean width greater than 1/4 inch or filled cracks that are at most lightly spalled but have filler in unsatisfactory condition;
- ◆ High - defined by cracks that are severely spalled, causing a definite FOD potential.

Repair Policies:

- ◆ Low - No action;
- ◆ Medium - seal cracks, apply rejuvenator, recycle surface or heat scarify and overlay;
- ◆ High - recycle surface or heat scarify and overlay.



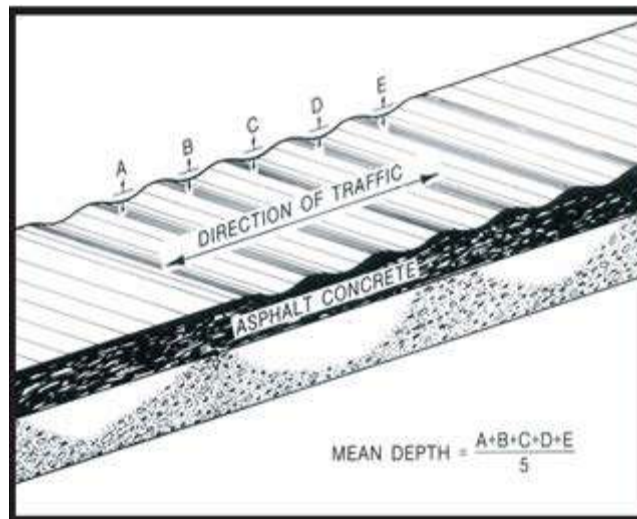
4. Corrugation (AC)

Description

Corrugation is a series of closely spaced ridges and valleys (ripples) occurring at fairly regular intervals, usually less than 5 feet (1.5 meters) along the pavement. The ridges are perpendicular to the traffic direction. Traffic action combined with an unstable pavement surface or base usually causes this type of distress.

Severity Levels

- Corrugations are minor and do not significantly affect ride quality (see measurement criteria below).
- Corrugations are noticeable and significantly affect ride quality (see measurement criteria below).
- Corrugations are easily noticed and severely affect ride quality (see measurement criteria below).



Depressions are localized pavement surface areas having elevations slightly lower than those of the surrounding pavement. In many instances, light depressions are not noticeable until after a rain, when ponding water creates “birdbath” areas; but the depressions can also be located without rain because of stains created by ponding of water. Depressions can be caused by settlement of the foundation soil or can be built during construction. Depressions cause roughness and, when filled with water of sufficient depth, could cause hydroplaning of aircraft.

Severities:

- ◆ Low - Depression can be observed or located by stained areas, only slightly affects pavement riding quality, and may cause hydroplaning potential on runways. Maximum depth 1/8 to 1/2 inch for runways, 1/2 to 1 inch for taxiways and aprons;
- ◆ Medium - The depression can be observed, moderately affects pavement riding quality, and causes hydroplaning potential on runways. Maximum depth 1/2 to 1 inch for runways, 1 to 2 inches for taxiways and aprons;
- ◆ High - The depression can be readily observed, severely affects pavement riding quality, and causes definite hydroplaning potential; Depth greater than 1 inch for runways, greater than 2 inches for taxiways and aprons;.

Repair Policies:

- ◆ Low - No action;
- ◆ Medium - Shallow, partial or full depth patch;
- ◆ High - Shallow, partial or full depth patch.



SYNOPSIS

Jet blast erosion causes darkened areas on the pavement surface when bituminous binder has been burned or carbonized; localized burned areas may vary in depth up to approximately 1/2 inch (13 millimeters).

DESCRIPTION

No degrees of severity are defined. It is sufficient to indicate that jet blast erosion exists.



7. Joint Reflection Cracking (AC)

SYNOPSIS

This distress occurs only on pavements having an asphalt or tar surface over a PCC slab. This category does not include reflection cracking from any other type of base (i. e., cement stabilized, lime stabilized); such cracks are listed as longitudinal and transverse cracks. Joint-reflection cracking is caused mainly by movement of the PCC slab beneath the AC surface because of thermal and moisture changes; it is not load related. However, traffic loading may cause a breakdown of the AC near the crack, resulting in spalling and FOD potential. If the pavement is fragmented along a crack, the crack is said to be spalled. A knowledge of slab dimensions beneath the AC surface will help to identify these cracks.

CRACK TYPES

Cracks have only light spalling (little or no FOD potential) or no spalling and can be filled or non-filled. If non-filled, the cracks have a mean width of 1/4 inch (6 millimeters) or less. Filled cracks are of any width, but their filler material is in satisfactory condition.

One of the following conditions exists: (1) cracks are moderately spalled (some FOD potential) and can be either filled or non-filled of any width; (2) filled cracks are not spalled or are only lightly spalled, but the filler is in unsatisfactory condition; (3) non-filled cracks are not spalled or are only lightly spalled, but the mean crack width is greater than 1/4 inch (6 millimeters); or (4) light random cracking exists near the crack or at the corner of intersecting cracks.

Cracks are severely spalled (definite FOD potential) and can be either filled or non-filled of any width.



Longitudinal and transverse (L&T) cracks are parallel to the pavement's centerline or laydown direction. They may be caused by: 1) a poorly constructed paving lane joint, 2) shrinkage of the AC surface due to hardening of the asphalt, or 3) a reflective crack caused by cracks beneath the surface course. Transverse cracks extend across the pavement perpendicularly to the pavement centerline or laydown direction, and may be caused by items 2) or 3) as stated above. These types of cracks are not usually load related.

Severities:

- ◆ Low - have either minor spalling or no spalling. The cracks can be filled or un-filled. Un-filled cracks have a mean width of 1/4 inch or less. Filled cracks are any width but their filler is in satisfactory condition;
- ◆ Medium - one of the following conditions exists: 1) cracks are moderately spalled and can be either filled or un-filled of any width; 2) filled cracks are not spalled or only lightly spalled, but the filler is in unsatisfactory condition; 3) un-filled cracks are not spalled or only lightly spalled, but the crack width exceeds 1/4 inch; or 4) light random cracking exists near the crack or at the corner of the intersecting cracks;
- ◆ High - severely spalled with a definite FOC potential. They can be either filled or un-filled.

Repair Policies:

- ◆ Low - No action;
- ◆ Medium - seal cracks;
- ◆ High - seal cracks or perform a full depth patch.



9. Oil Spillage (AC)

Oil spillage is the deterioration or softening of the pavement surface caused by the spilling of oil, fuel, or other solvents.

Severities: No degrees of severity are defined. It is sufficient to indicate that oil spillage exists.

Repair Policies:

- ◆ Do nothing;
- ◆ Partial or full depth patch.



10. Patching

Repair patching and utility cut patching is considered a defect, regardless of how well it performs or was constructed.

Severities:

- ◆ Low - in good condition and is performing satisfactorily;
- ◆ Medium - is somewhat deteriorated and affects riding quality to some extent;
- ◆ High - is badly deteriorated and affects riding quality significantly or has high FOD potential.

Repair options:

- ◆ Low - No action;
- ◆ Medium - seal cracks, repair the distresses in the patch or replace the patch;
- ◆ High - replace the patch.



Figure C.7: Asphalt Patching.

11. Polished Aggregate (AC)

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Aggregate polishing is caused by repeated traffic applications. Polished aggregate is present when close examination of a pavement reveals that the portion of aggregate extending above the asphalt is either very small or there are no rough or angular aggregate particles to provide good skid resistance. Existence of this type of distress is also indicated when the number on a skid resistance rating test is low or has dropped significantly from previous ratings.

GjYfln@jYg

No degrees of severity are defined. However, the degree of polishing should be significant before it is included in the condition survey and rated as a defect.



12. Raveling (AC)

Raveling is the dislodging of coarse aggregate particles from the pavement surface .

Severity of Raveling

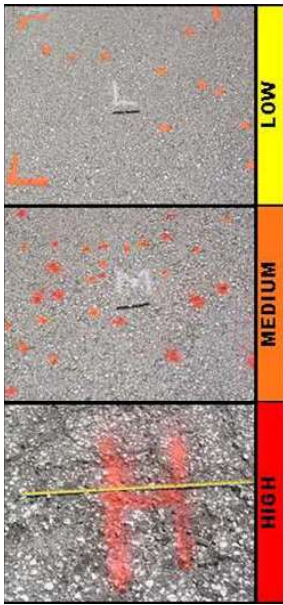
As used herein, coarse aggregate refers to predominant coarse aggregate sizes of the asphalt mix. Aggregate clusters refer to when more than one adjoining coarse aggregate piece is missing. If in doubt about a severity level, three representative areas of 1 square yard (1 square meter) each should be examined and the number of missing coarse aggregate particles counted.

Low severity occurs if any one of these conditions exist: (1) In a square yard (square meter) representative area, the number of coarse aggregate particles missing is between 5 and 20. (2) Missing aggregate clusters is less than 2 percent of the examined square yard (square meter) area. In low severity raveling, there is little or no FOD potential.

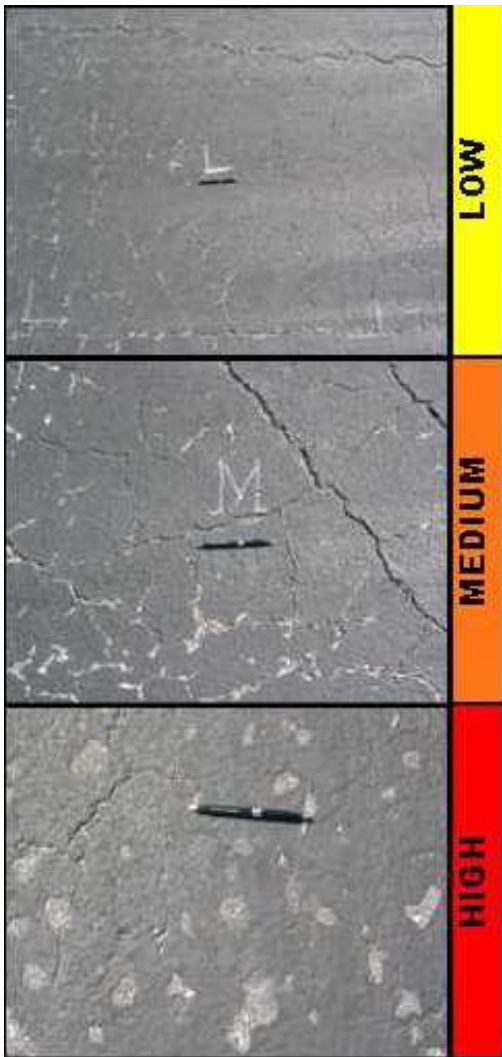
Medium severity occurs if any one of these conditions exist: (1) In a square yard (square meter) representative area, the number of coarse aggregate particles missing is between 21 and 40. (2) Missing aggregate clusters is between 2 and 10 percent of the examined square yard (square meter) area. In medium severity raveling, there is some FOD potential.


High severity occurs if any one of these conditions exist: (1) In a square yard (square meter) representative area, the number of coarse aggregate particles missing is over 40. (2) Missing aggregate clusters is more than 10 percent of the examined square yard (square meter) area. In high severity raveling, there is significant FOD potential.


Measurement of Raveling




Gi ffr#7cUHfCjY8YgYAl GYfJh@Yg



 (1) The scaled area is less than 1 percent. (2) In the case of coal tar where pattern cracking has developed, the surface cracks are less than 1/4 inch (6 mm) wide.

 (1) The scaled area is between 1 and 10 percent. (2) In the case of coal tar where pattern cracking has developed, the cracks are 1/4 inch (6 mm) wide or greater.

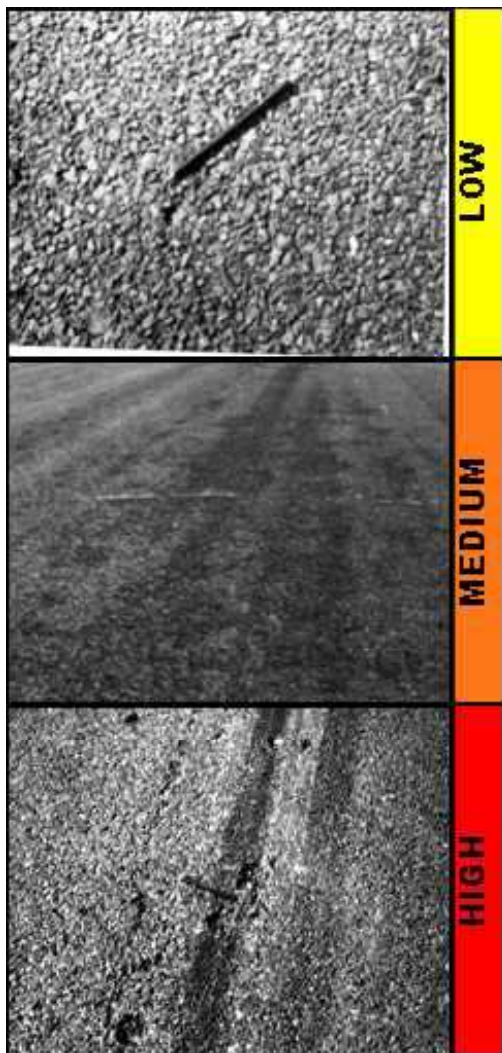
 (1) The scaled area is over 10 percent. (2) In the case of coal tar the surface is peeling off.

Dfci g: fMcb7ci fgYGjYfhi@jYg

In a 1 square foot (1/10 square meter) representative sample, the number of aggregate pieces missing is between 5 and 20 and/ or the number of missing aggregate clusters does not exceed 1.

In a 1 square foot (1/10 square meter) representative sample, the number of aggregate pieces missing is between 21 and 40 and/ or the number of missing aggregate clusters is greater than 1 but does not exceed 25 percent of the area.

In a 1 square foot (1/10 square meter) representative sample, the number of aggregate pieces missing is over 40 and/ or the number of missing aggregate clusters is greater than 25 percent of the area.



13. Rutting (AC)

A rut is a surface depression in the wheel path; however, in many instances ruts are noticeable only after a rainfall, when the wheel paths are filled with water. Pavement uplift may occur along the sides of the rut. Rutting stems from a permanent deformation in any of the pavement layers or sub-grade, usually caused by consolidation or lateral movement of the materials due to traffic loads. Significant rutting can lead to major structural failure of the pavement.

Severities (based on rut depth):

- ◆ Low - less than ½ inch in depth;
- ◆ Medium - between ½ and 1 inch in depth;
- ◆ High - exceeds 1 inch in depth.

Repair options:

- ◆ Low - No action;
- ◆ Medium - patch and/or overlay;
- ◆ High - patch and/or overlay.



Figure C.9: AC Rutting.

14. Slippage Cracking (AC)

Slippage cracks are crescent- or half-moon shaped cracks having two ends pointed away from the direction of traffic. They are produced when braking or turning wheels cause the pavement surface to slide and deform. This usually occurs when there is a low-strength surface mix or poor bond between the surface and next layer of pavement structure.

Severities: No degrees of severity are defined. It is sufficient to indicate that a slippage crack exists.

Repair Policies:

- ◆ Do nothing;
- ◆ Partial or full depth patch.



Figure C.10: Slippage Cracking.

15. Swelling (AC)

SYG/d/b

A swell is characterized by an upward bulge in the pavement's surface. A swell may occur sharply over a small area or as a longer, gradual wave. Either type of swell can be accompanied by surface cracking. A swell is usually caused by frost action in the subgrade or by swelling soil, but a small swell can also occur on the surface of an asphalt overlay (over PCC) as a result of a blow-up in the PCC slab.

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Swell is barely visible and has a minor effect on the pavement's ride quality as determined at the normal aircraft speed for the pavement section under consideration. (Low-severity swells may not always be observable, but their existence can be confirmed by driving a vehicle over the section at the normal aircraft speed. An upward acceleration will occur if the swell is present).

Swell can be observed without difficulty and has a significant effect on the pavement's ride quality as determined at the normal aircraft speed for the pavement section under consideration.

Swell can be readily observed and severely affects the pavement's ride quality at the normal aircraft speed for the pavement section under consideration.



16. Weathering (AC)

SYNOPSIS

The wearing away of the asphalt binder and fine aggregate matrix from the pavement surface.

DEFINITION

Asphalt surface beginning to show signs of aging which may be accelerated by climatic conditions. Loss of the fine aggregate matrix is noticeable and may be accompanied by fading of the asphalt color. Edges of the coarse aggregates are beginning to be exposed (less than 0.05 inches or 1 mm). Pavement may be relatively new (as new as 6 months old).

Loss of fine aggregate matrix is noticeable and edges of coarse aggregate have been exposed up to 1/4 width (of the longest side) of the coarse aggregate due to the loss of fine aggregate matrix.




Edges of coarse aggregate have been exposed greater than 1/4 width (of the longest side) of the coarse aggregate. There is considerable loss of fine aggregate matrix leading to potential or some loss of coarse aggregate.

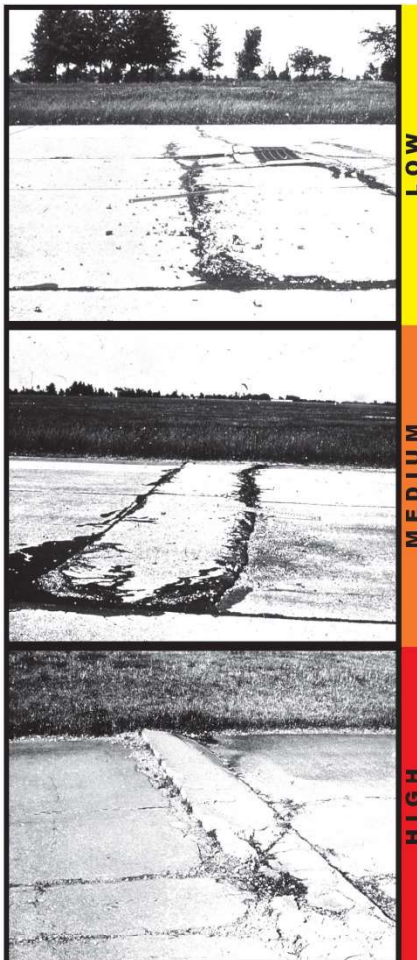


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Blowups occur in hot weather, usually at a transverse crack or joint that is not wide enough to permit expansion by the concrete slabs. The insufficient width is usually caused by infiltration of incompressible materials into the joint space. When expansion cannot relieve enough pressure, a localized upward movement of the slab edges (buckling) or shattering will occur in the vicinity of the joint. Blowups can also occur at utility cuts and drainage inlets. This type of distress is almost always repaired immediately because of severe damage potential to aircraft. Blowups are included for reference when closed sections are being evaluated for reopening.

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-  Buckling or shattering has not rendered the pavement inoperative, and only a slight amount of roughness exists.
-  Buckling or shattering has not rendered the pavement inoperative, but a significant amount of roughness exists.
-  Buckling or shattering has rendered the pavement inoperative.



A corner break is a crack that intersects the joints at a distance less than or equal to one-half the slab length on both sides, measured from the corner of the slab. For example, a slab with dimensions of 25 by 25 feet that has a crack intersecting the joint 5 feet from the corner on one side and 17 feet on the other side is not considered a corner break; it is a diagonal crack. However, a crack that intersects 7 feet on one side and 10 feet on the other is considered a corner break. A corner break differs from a corner spall in that the crack extends vertically through the entire slab thickness, while a corner spall intersects the joint at an angle. Load repetition combined with loss of support and curling stresses usually causes corner breaks.

Severities:

- ◆ Low - Crack has either no spalling or minor spalling (no foreign object damage (FOD) potential). If non-filled, it has a mean width less than approximately 1/8 inch (3 millimeters); a filled crack can be of any width, but the filler material must be in satisfactory condition. The area between the corner break and the joints is not cracked;
- ◆ Medium - One of the following conditions exists: (1) filled or non-filled crack is moderately spalled (some FOD potential); (2) a non-filled crack has a mean width between 1/8 inch (3 millimeters) and 1 inch (25 millimeters); (3) a filled crack is not spalled or only lightly spalled, but the filler is in unsatisfactory condition; (4) the area between the corner break and the joints is lightly cracked with loose or missing particles;
- ◆ High - One of the following conditions exists: (1) filled or non-filled crack is severely spalled, causing definite FOD potential; (2) a non-filled crack has a mean width greater than approximately 1 inch (35 millimeters), creating a tire damage potential; or (3) the area between the corner break and the joints is severely cracked.

Repair options:

- ◆ Low - No action or seal cracks;
- ◆ Medium - seal cracks;
- ◆ High - seal cracks, apply a full or replace the slab.



Figure C.11: PCC Corner Break.

These cracks divide the slab into two or three pieces, and are usually caused by a combination of load repetition, curling stresses, and shrinkage stresses. Low severity cracks are not considered major structural distresses. Medium or high severity cracks are usually working cracks and are considered major structural distresses.

Severities:

- ◆ Low - 1) unfilled cracks 1/4 inch to 1/2 inch wide with no faulting or spalling; 2) cracks less than 1/2 inch wide with low severity spalling; or 3) filled cracks of any width, with filter performing in a satisfactory manner and no faulting or spalling;
- ◆ Medium - 1) un-filled cracks between 1/2 to 1 inch wide with no faulting or spalling or 2) filled cracks of any width faulting less than 1/8 inch or medium severity spalling;
- ◆ High - 1) un-filled cracks with a width greater than 1 inch; 2) un-filled cracks of any width with faulting greater than 1/2 inch or medium severity faulting; or 3) filled cracks of any width faulting greater than 1/2 inch or high severity faulting.

Repair options:

- ◆ Low - No action or seal cracks;
- ◆ Medium - seal cracks;
- ◆ High - seal cracks, apply a full depth patch or replace the slab.



Figure C.12: PCC Transverse Cracks.

8Y9Adbb

Durability cracking is caused by the inability of the concrete to withstand environmental factors such as freeze-thaw cycles. It usually appears as a pattern of cracks running parallel to a joint or linear crack. A dark coloring can usually be seen around the fine durability cracks. This type of cracking may eventually lead to disintegration of the concrete within 1 to 2 feet (300 to 600 millimeters) of the joint or crack.

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- “D” cracking is defined by hairline cracks occurring in a limited area of the slab, such as one or two corners or along one joint. Little or no disintegration has occurred. No FOD potential.
- (1) “D” cracking has developed over a considerable amount of slab area with little or no disintegration or FOD potential; or (2) “D” cracking has occurred in a limited area of the slab, such as in one or two corners or along one joint, but pieces are missing and disintegration has occurred. Some FOD potential.
- “D” cracking has developed over a considerable amount of slab area with disintegration of FOD potential.



Joint seal damage is any condition, which enables soil or rocks to accumulate in the joints or allow significant infiltration of water. Accumulation of incompressible materials in the joint prevents the slab from expanding and may result in buckling, shattering, or spalling. Pliable joint filler bonded to the edges of the slabs protects joints from the accumulation of materials and also prevents water from seeping down and softening the foundation supporting the slab. Typical types of joint seal damage are: 1) stripping the joint sealant; 2) extrusion of joint sealant; 3) weed growth; 4) hardening of the filler; 5) loss of bond to the slab edges; and 6) lack or absence of sealant in the joint.

Severities:

- ◆ Low - in generally good condition throughout the section. Sealant is performing well with only a minor amount of any of the above types of damage present;
- ◆ Medium - in generally fair condition throughout the section, with one or more of any of the above types of damage present occurring to a moderate degree. Sealant needs immediate replacement within 2 years;
- ◆ High - in generally poor condition throughout the section, with one or more of any of the above types of damages present, occurring to a severe degree. Sealant needs immediate replacement.

Repair options:

- ◆ Low - No action;
- ◆ Medium - seal joints;
- ◆ High - seal joints.



Figure C.13: PCC Joint Seal Damage.

A patch is an area where the original pavement has been removed and replaced by a filler material. For condition evaluation, patching is divided into two types: small (less than 5 square feet) and large (over 5 square feet). Large patches are described in the next section.

Severities:

- ◆ Low - Patch is functioning well, with little or no deterioration;
- ◆ Medium - Patch has deteriorated, and/or moderate spalling can be seen around the edges. Patch material can be dislodged, with considerable effort (minor FOD potential);
- ◆ High - Patch has deteriorated, either by spalling around the patch or cracking within the patch, to a state which warrants replacement.

Repair options:

- ◆ Low – Do Nothing;
- ◆ Medium - Replace patch or replace the slab;
- ◆ High – Replace patch or replace the slab.



Figure C.14: PCC Small Patch.

Patching is the same as defined for a small patch; however, the area of the patch is more than 5 square feet. A utility cut is a patch that has replaced the original pavement because of placement of underground utilities. The severity levels of a utility cut are the same as those for regular patching..

Severities:

- ◆ Low - Patch is functioning well, with little or no deterioration;
- ◆ Medium - Patch has deteriorated, and/or moderate spalling can be seen around the edges. Patch material can be dislodged, with considerable effort (minor FOD potential);
- ◆ High - Patch has deteriorated, either by spalling around the patch or cracking within the patch, to a state which warrants replacement.

Repair options:

- ◆ Low – Do Nothing;
- ◆ Medium - Replace patch or replace the slab;
- ◆ High – Replace patch or replace the slab.



Figure C.15: PCC Large Patch.

A popout is a small piece of pavement that breaks loose from the surface due to freeze-thaw action in combination with expansive aggregates. Popouts usually range from approximately 1 inch to 4 inches in diameter and from 1/2 inch to 2 inches deep..

Severities:

No degrees of severity are defined for popouts. However, popouts must be extensive before they are counted as a distress; i.e., average popout density must exceed approximately three popouts per square yard over the entire slab area.



Figure C.16: Popouts.

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Pumping is the ejection of material by water through joints or cracks caused by deflection of the slab under passing loads. As the water is ejected, it carries particles of gravel, sand, clay, or silt and results in a progressive loss of pavement support. Surface staining and base or subgrade material on the pavement close to joints or cracks are evidence of pumping. Pumping near joints indicates poor joint sealer and loss of support which will lead to cracking under repeated loads.

GjYf1n@jYg

No degrees of severity are defined. It is sufficient to indicate that pumping exists.



Map cracking or crazing refers to a network of shallow, fine, or hairline cracks that extend only through the upper surface of the concrete. The cracks tend to intersect at angles of 120 degrees. Map cracking or crazing is usually caused by over finishing the concrete and may lead to scaling of the surface, which is the breakdown of the slab surface to a depth of approximately 1/4 to 1/2 inch. Scaling may also be caused by improper construction and poor aggregate. Another recognized source of distress is the reaction between the alkalis (Na_2O and K_2O) in some cements and certain minerals in some aggregates. Products formed by the reaction between the alkalis and aggregate result in expansions that cause a breakdown in the concrete.

Severities:

- ◆ Low - Crazing or map cracking exists over significant slab area. The surface is in good condition with no scaling. The crack pattern must be well defined and easily recognized;
- ◆ Medium - Slab is scaled over approximately 5% or less of the surface with some FOD potential;
- ◆ High - Slab is severely scaled causing a high FOD potential. Usually, more than 5% of the surface is affected.



Settlement or faulting is a difference of elevation at a joint or crack caused by upheaval or consolidation.

Severities:

Severity levels are defined by the difference in elevation across the fault and the associated decrease in ride quality and safety as severity increases.

	< 1/4 inch	1/8 – 1/2 inch
	1/4 – 1/2 inch	1/2 - 1 inch
	> 1/2 inch	> 1 inch

Repair Options:

- ◆ Low - No action;
- ◆ Medium – Grinding along the joint;
- ◆ High – Grinding or joint load transfer restoration.



Intersecting cracks are cracks that break into four or more pieces because of overloading and/or inadequate support. The high-severity level of this distress type, as defined below, is referred to as a shattered slab. If all pieces or cracks are contained within a corner break, the distress is categorized as a severe corner break.

Severities:

- ◆ Low - Slab is broken into four or five pieces with the vast majority of the cracks (over 85 percent) of low-severity;
- ◆ Medium - (1) Slab is broken into four or five pieces with over 15 percent of the cracks of medium severity (no high-severity cracks); or (2) slab is broken into six or more pieces with over 85 percent of the cracks of low-;
- ◆ High - At this level of severity, the slab is called shattered: (1) slab is broken into four or five pieces with some or all of the cracks of high severity; (2) slab is broken into six or more pieces with over 15 percent of the cracks of medium- or high-severity.

Repair options:

- ◆ Low – Seal Cracks;
- ◆ Medium - Full depth patch or replace the slab;
- ◆ High - Full depth patch or replace the slab.



Shrinkage cracks are hairline cracks that are usually only a few feet long and do not extend across the entire slab. They are formed during the setting and curing of the concrete and usually do not extend through the depth of the slab.

Severities:

No degrees of severity are defined. It is sufficient to indicate that shrinkage cracks exist.

Repair options:

- ◆ Do Nothing



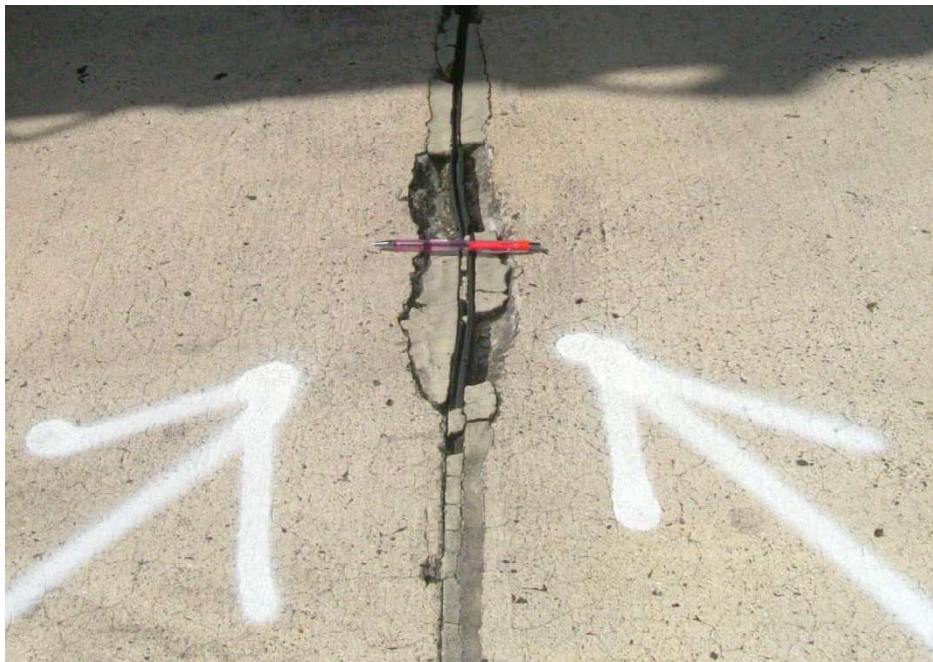
Joint spalling is the disintegration of the slab edges within 2 feet of the side of the joint. A joint spall usually does not extend vertically through the slab, but intersects the joint at an angle. Spalling results from excessive stresses at the joint crack caused by infiltration of incompressible materials or traffic loads. Weak concrete at the joint (caused by overworking) combined with traffic loads is another cause of spalling.

Severities:

- ◆ Low - over 2 feet long and is broken into no more than three pieces defined by low or medium severity cracks, with little or no FOD potential, or is 2) less than 2 feet long and is broken into more than three pieces, with little FOD or tire damage potential;
- ◆ Medium - over 2 feet long and is broken into more than 3 pieces defined by light or medium cracks or some FOD potential existing, or is 2) less than 2 feet long and is broken into pieces or fragmented, with some of the pieces loose or absent, causing considerable FOD or tire damage potential;
- ◆ High - over 2 feet long and is broken into more than three pieces defined by one or more high severity cracks with high FOD potential.

Repair Options:

- ◆ Low - No action;
- ◆ Medium - perform a partial depth patch;
- ◆ High - perform a partial depth patch.



Corner spalling is the raveling or breakdown of the slab within approximately 2 feet of the corner. A corner spall differs from a corner break in that the spall angles downward to intersect the joint while the break extends vertically through the slab.

Severities:

- ◆ Low - either 1) the spall is broken into one or two pieces defined by low severity cracks with little or no FOD potential; or 2) the spall is defined by one medium severity crack with little or no FOD potential;
- ◆ Medium – 1) the spall is broken into two or more pieces defined by medium severity cracks, and a few small fragments may be absent or loose; 2) the spall is defined by one severe, fragmented crack that may be accompanied by a few hairline cracks or 3) the spall has deteriorated to the point where loose material is causing FOD potential;
- ◆ High – 1) the spall has broken into two or more pieces defined by high severity fragmented cracks, with loose or absent fragments; 2) pieces of the spall have been displaced to the extent that tire damage hazard exists, or 3) the spall has deteriorated to the point where loose material is causing high FOD potential.

Repair Options:

- ◆ Low - No action;
- ◆ Medium - partial depth patch;
- ◆ High - partial depth patch.



ASR is caused by chemical reaction between alkalis and certain reactive silica minerals which form a gel. The gel absorbs water, causing expansion which may damage the concrete and adjacent structures. Alkalis are most often introduced by the portland cement within the pavement. ASR cracking may be accelerated by chemical pavement deicers.

Visual indicators that ASR may be present include:

1. Cracking of the concrete pavement (often in a map pattern)
2. White, brown, gray or other colored gel or staining may be present at the crack surface
3. Aggregate popouts
4. Increase in concrete volume (expansion) that may result in distortion of adjacent or integral structures or physical elements. Examples of expansion include shoving of asphalt pavements, light can tilting, slab faulting, joint misalignment, and extrusion of joint seals or expansion joint fillers.

Because ASR is material-dependent, ASR is generally present throughout the pavement section. Coring and concrete petrographic analysis is the only definitive method to confirm the presence of ASR. The following should be kept in mind when identifying the presence of ASR through visual inspection:

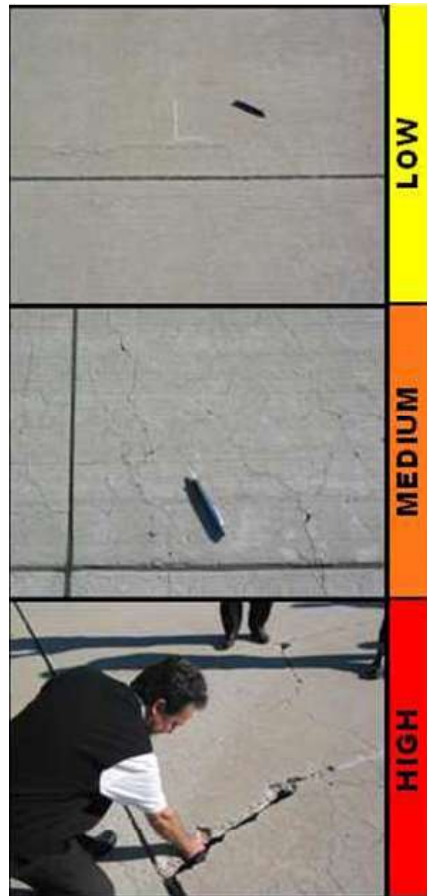
1. Generally ASR distresses are not observed in the first few years after construction. In contrast, plastic shrinkage cracking can occur the day of construction and is apparent within the first year.
2. ASR is differentiated from D-Cracking by the presence of cracking perpendicular to the joint face. D-Cracking predominantly develops as a series of parallel cracks to joint faces and linear cracking within the slab.
3. ASR is differentiated from Map Cracking/ Scaling by the presence of visual signs of expansion.

Minimal to no Foreign Object Damage (FOD) potential from cracks, joints or ASR related popouts; cracks at the surface are tight (predominantly 1 mm or less). Little to no evidence of movement in pavement or surrounding structures or elements.

Some FOD potential; increased sweeping or other FOD removal methods may be required. May be evidence of slab movement and/ or some damage to adjacent structures or elements.

Medium ASR distress is differentiated from low by having one or more of the following: increased FOD potential, increased cracking of the slab, some fragments along cracks or at crack intersections present, surface popouts of concrete may occur, pattern of wider cracks (predominantly 1 mm or wider) that may be subdivided by tighter cracks.

One or both of the following exist: 1) Loose or missing concrete fragments which pose high FOD potential, 2) Slab surface integrity and function significantly degraded and pavement requires immediate repair; may also require repairs to adjacent structures or elements.



APPENDIX D

DETAILED PAVEMENT CONDITION DATA



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(' 6@C7: 7F57?-B;	A		' S) 'SS G: h
() 89DF9GCB	@		%SS G: h
) + K95H: 9F-B;	@		SS +'SS G: h
) + K95H: 9F-B;	A		SS +'SS G: h
GladYBi aVF. \$	HndY	F	5fU)SSSS G: h D7= '+
GladY7caaYlg			
(' 6@C7: 7F	@		*SSSS G: h
(' 6@C7: 7F	A		&SSSS G: h
() 89DF9GCB	@		%SSSS G: h
(, @/ H7F	A		&'SS : h
) + K95H: 9F-B;	@		&SSSS G: h
) + K95H: 9F-B;	A		&SSSS G: h
GladYBi aVF. \$	HndY	F	5fU)SSSS G: h D7= '+
GladY7caaYlg			
(' 6@C7: 7F	@		' SSSS G: h
(' 6@C7: 7F	A		%SSSS G: h
() 89DF9GCB	@		%SSSS G: h
(, @/ H7F	@		%SSSS : h
(, @/ H7F	A		&('SS : h
) + K95H: 9F-B;	@		&SSSS G: h
) + K95H: 9F-B;	A		&SSSS G: h

BVkc_f.	; N		BUaY	9jMfNYbFY]cbU5]fcbfBA]XXlab:]YX			
GfUW	HS&		BUaY	HI]kUis\$9jMfNYb	IgX	H5L-K5M	5fU
GMfch	%	cZ %	: fca.	HI]kUisDUY\$&		H. 5drb\$%	@g]7cbg]l %%%()
GfZUW	57	: Ua]m	5@SCH57HI]kUig	NdbY		7UH]cfm	FUb. G
5fU		%&*) G&h	@Y[h.	%) :h	K]Ph.	' \$:h	
GUg		GUv@Y[h.	:h	GUVK]Ph.	:h	>cbh@Y[h.	:h
Gci Xf.		GfYWHndY		; fUX \$		@bg \$	
GMfcb7caaYlg							
Kcf_8UY %%%()		Kcf_HndY	Bk7cbg]l Vcb:]h]U		7cXV BI!-B		=gAUcfA/ F. HfY
@g]7cbg]l 8UY %%%&S%		HRUcladYg	&		GfjYnX	&	
7cb]h]g D7= **							
hg]lV]cb7caaYlg							
CladYBiaVf. \$%		HndY	F	5fU	*%*'SSG&h	D7= +*	
CladY7caaYlg							
(, @/ H7F		@		%SS :h			
(, @/ H7F		A		%SS :h			
CladYBiaVf. S&		HndY	F	5fU	*%SSG&h	D7=)*	
CladY7caaYlg							
(' 6@C7? 7F		@		%)SS G&h			
(, @/ H7F		@		%SS :h			
(, @/ H7F		A		%SS :h			
)+ K95H:9F-B;		@		' \$*'SS G&h			
)+ K95H:9F-B;		A		' \$*'SS G&h			

BYkcf. ; Nc BLaY 9jMfNYbFY]cbU5]fcbfBA]XXlab:]YX

GfUW H7S% BLaY HI]kUirdbbNMfS%9jMfNYb I gX H5L-K5M 5fYU %z+, Gc h

GMfch \$% cZ % : fca. FibkUirS% H. HI]kUirDUY\$% @gh7cbgH %4SS

GfZAW 57 : Ua]m 5@SCH57HI]kUig NcbY 7UH]cfm FUb. G

5fYU %z+, Gc h @Y[h. &) : h K]Ph.)S: h

GUg GUV@Y[h. : h GUVK]Ph. : h >ch@Y[h. : h

Gci Xf. GfYWHdY ; fUX \$ @Ug \$

GMfcb7caa Ylg

Kcf_8UY %4%() Kcf_HdY Bk7cbgU]cb:]HJU 7cXV BI!B gAUcfA/ F. HiY

Kcf_8UY %4SS Kcf_HdY 7cXA]~&/ &C]Yfm 7cXV 7A!C@& gAUcfA/ F. HiY

@gh7cbgH'8UY %4+SS% HRUcladYg ' GfjYXK '

7cbH]cbg D7= ' -

-bgNMfcb7caa Ylg

QladYBi aVf. \$% HdY F 5fYU)+SSSSGc h D7= '*

QladY7caa Ylg

(' 6@C7: 7F @ ,+) 'SS Gc h

(' 6@C7: 7F A ',+) 'SS Gc h

(, @/ H7F A ,) 'SS : h

) + K95H 9F-B; @ ' &S'SS Gc h

) + K95H 9F-B; A %SSSS Gc h

QladYBi aVf. S& HdY F 5fYU (*' %SSGc h D7= ('

QladY7caa Ylg

(' 6@C7: 7F @ %SSSS Gc h

(' 6@C7: 7F57? -B; A ''' %SS Gc h

) + K95H 9F-B; @ (*' %SS Gc h

QladYBi aVf. \$ HdY F 5fYU ' ((&SSGc h D7= ' -

QladY7caa Ylg

(' 6@C7: 7F @ SSSSS Gc h

(' 6@C7: 7F A %SSSS Gc h

() 89IF9GCB @ %)'SS Gc h

(, @/ H7F @ (+ 'SS : h

(, @/ H7F A & SSS : h

) + K95H 9F-B; @ %&SS Gc h

) + K95H 9F-B; A %&SS Gc h

BVkf.	; N	BLAY	9jMfNYbFY]cbU5]fcbfA]XXlab:]YX				
GFUW	H7S&	BLAY	HI]kUn7dbNMfS&9jMfNYb I g	H5L-K5M	5fU	%&- , G& h	
GM]ch	%	cZ %	: fca. FibkUn7S&	H. HI]kUnDUY'S&		@]h7cb]h' %%%()	
GfZUW	57	: Ua]m	5@SCH57HI]kUg NcbY	7UH]cfm		FUb. G	
5fU	%&- , G& h	@]h.	9) : h	K]h.	)S: h		
GUg		GUv@]h.	: h	GUvK]h.	: h	>]h@]h.	: h
Gci Xf.		GfYvHndY	; fUX \$			@]h \$	
GM]cb7caaYhg							
Kcf_8UY %%%()		Kcf_HndY Bk7cb]h']h]U		7cX BI!-B		=AUcfA/ F. H]Y	
@]h]h]h]8UY %&+S%		HRUcladYg '		GfjYhX '			
7cb]h]h]g D7= '+							
=hgNM]cb7caaYhg							
GladyBiaVf. %		HndY	F	5fU	) (, SSS G& h	D7= '+	
Glady7caaYhg							
(' 6@C7? 7F57?-B;		A		) (, SSS G& h			
) + K95H 9F-B;		@		&(%SS G& h			
) + K95H 9F-B;		A		&(%SS G& h			
GladyBiaVf. S&		HndY	F	5fU	) SSSSS G& h	D7= '+	
Glady7caaYhg							
(' 6@C7? 7F		A		) SSSSS G& h			
) + K95H 9F-B;		@		&SSSS G& h			
) + K95H 9F-B;		A		&SSSS G& h			
GladyBiaVf. \$		HndY	F	5fU	'%&'SS G& h	D7= '+	
Glady7caaYhg							
(' 6@C7? 7F57?-B;		A		'%&'SS G& h			
) + K95H 9F-B;		@		%) , 'SS G& h			
) + K95H 9F-B;		A		%) , 'SS G& h			

BYkcf. ; N	BláY		9jM(fybFy]cbU5]fcbfBA]XXlab:]YX		
GfUW H 5B; %	BláY	HI]kUia U]f\$%9jM]fyb	I g	H5L-K5M 5fU	&Z- &Gh
GWfch %	cZ %	: fca.	5dcb%	H. H<U]Ug	@]h7cbg] %%%()
GfUW 57	: Ua]m 5@SCH57HI]U]g	NbY		7U]cfm	Fub. H
5fU	&Z- &Gh	@]h.	%\$: h	K]h.	%) : h
GUg	GU@]h.	: h	GUVK]h.	: h	>cb]h@]h. : h
Gci Xf.	GfY]HhY		; fUX \$		@]bg \$
GWfcb7caaYhg					
Kcf_8UY %%%()	Kcf_HhY Bk7cbg]U]cb:]h]U			7cX BI!B	=AUcfA/ F. HhY
@]h]h]8UY %%%%	HRUcláYg *			GfjYhX *	
7cb]h]hg D7= *\$					
hg]h]cb7caaYhg					
GldYBiaVf. %	HhY	F	5fU	()%\$\$Gh	D7=)+
GldY7caaYhg					
(, @/ H7F	@		%\$\$: h		
(, @/ H7F	A		%\$' : h		
)\$ D5H<-B;	@		'-'\$\$ Gh		
)\$ D5H<-B;	A		'-'\$\$ Gh		
)& F5J9@B;	<		%\$\$ Gh		
)+ K95H 9F-B;	@		&&%\$\$ Gh		
)+ K95H 9F-B;	A		&&%\$\$ Gh		
GldYBiaVf. &&	HhY	F	5fU	)- &'\$\$Gh	D7= *)
GldY7caaYhg					
(, @/ H7F	@		*\$\$: h		
(, @/ H7F	A		&\$: h		
)+ K95H 9F-B;	@		&*'\$\$ Gh		
)+ K95H 9F-B;	A		&*'\$\$ Gh		
GldYBiaVf. \$	HhY	F	5fU	&('\$\$Gh	D7= *\$
GldY7caaYhg					
(, @/ H7F	@		-'\$\$: h		
(, @/ H7F	A		%\$' : h		
)+ K95H 9F-B;	@		%&&& Gh		
)+ K95H 9F-B;	A		%&&& Gh		
GldYBiaVf. \$	HhY	F	5fU	), '\$\$Gh	D7= **
GldY7caaYhg					
(, @/ H7F	@		&)' : h		
(, @/ H7F	A		%&& : h		
)+ K95H 9F-B;	@		&- ('\$\$ Gh		
)+ K95H 9F-B;	A		&- ('\$\$ Gh		
GldYBiaVf. \$	HhY	F	5fU	((, '\$\$Gh	D7= (+
GldY7caaYhg					
() 89DF9GCB	@		%&&& Gh		
() 89DF9GCB	A		*\$\$ Gh		
(, @/ H7F	@		%&& : h		
(, @/ H7F	A		%&& : h		
(, @/ H7F	<		)' : h		
)+ K95H 9F-B;	@		&&- '\$\$ Gh		
)+ K95H 9F-B;	A		&&- '\$\$ Gh		
GldYBiaVf. \$	HhY	F	5fU	'-, '\$\$Gh	D7= *%
GldY7caaYhg					
(, @/ H7F	@		, '\$\$: h		
(, @/ H7F	A		%\$: h		
)+ K95H 9F-B;	@		%- && Gh		
)+ K95H 9F-B;	A		%- && Gh		

BYkcf. ; N			BláY	9jMfNYbFY]cbU5]fcbfBA]XXlab:]YX		
GfUW HD%		BláY	HI]kúúúfUY'S%9jMfNYb	I g	H5L-K5M	5fU
GMfch \$	cZ (	: fca.	GMfcb\$		H. Filkúúú%	@]h7cbg' %4SS
GfUW 57	: Ua]m	5@SCH57HI]kúúú	NbY		7UH]cfm	Fub. D
5fU	'-ž+%Geh	@]h.	+ \$: h	K]h.	)\$: h	
GUg	GU@]h.	: h	GUVK]h.	: h	>]h@]h.	: h
Gci Xf.	GfYWHdY		; fUX \$		@]h \$	
GMfcb7caaYhg						
Kcf_8UY %4%)	Kcf_HdY	Bk7cbg' Vcb' :h]U		7cXV	BI !-B	=AUcfA/ F. HiY
Kcf_8UY %4SS	Kcf_HdY	7cXA]~&/ &C]Yfm		7cXV	7A!C@&	=AUcfA/ F. HiY
@]h:hg'8UY %4+SS%		HBUcladyg ,		GfjYhX (
7cb]hbg D7= '-						
-hg]h]cb7caaYhg						
QádYBi aVf. \$%	HdY	F	5fU	)(-'SS Geh	D7= '+	
QádY7caaYhg						
(' 6@C7? 7F57?-B;	A		)(-'SS Geh			
)+ K95H 9F-B;	@		&+('SS Geh			
)+ K95H 9F-B;	A		&+('SS Geh			
QádYBi aVf. \$	HdY	F	5fU	)SS\$SS Geh	D7= '-	
QádY7caaYhg						
(' 6@C7? 7F	@		- SS\$SS Geh			
(' 6@C7? 7F	A		&SS\$SS Geh			
(, @/ H7F	A		%SS\$: h			
)+ K95H 9F-B;	@		&SS\$SS Geh			
)+ K95H 9F-B;	A		&SS\$SS Geh			
QádYBi aVf. \$	HdY	F	5fU	)SS\$SS Geh	D7= '-	
QádY7caaYhg						
(' 6@C7? 7F	@		)SS\$SS Geh			
(' 6@C7? 7F	A		' SS\$SS Geh			
(, @/ H7F	@		(\$SS : h			
(, @/ H7F	A		& \$SS : h			
)+ K95H 9F-B;	@		&SS\$SS Geh			
)+ K95H 9F-B;	A		&SS\$SS Geh			
QádYBi aVf. \$-	HdY	F	5fU	)SS\$SS Geh	D7= ('	
QádY7caaYhg						
(' 6@C7? 7F	@		%SS\$SS Geh			
(' 6@C7? 7F	A		SS\$SS Geh			
(, @/ H7F	A		%SS\$: h			
)+ K95H 9F-B;	@		&SS\$SS Geh			
)+ K95H 9F-B;	A		&SS\$SS Geh			

BYkcf. ; N			BláY	9jMfNYbFY]cbU5]fcbfBA]XXlab:]YX		
GfUW HD%			BláY	HI]kúúúfUY'9]9jMfNYb I g	H5L-K5M	5fU
GWfch \$%		cZ (	: fca.	Fibkúúú%	H. GWfcb\$&	@g]7cbg]H %&&&%
GfUW 57		: Uá]m	5@SCH57HI]kúúg	NbY	7UH]cfm	Fub. D
5fU		*-ž*- Gc h	@Y[h.	%&): h	K]Ph.	)\$: h
GUg		GU@Y[h.	: h	GUVK]Ph.	: h	>cbh@Y[h. : h
Gci Xf.		GfYWHdY		; fUX \$		@Ug \$
GWfcb7caaYlg						
Kcf_8UY %&&&%		Kcf_HdY	Bk7cbg]Vcb']H]U		7cX BI !-B	=gAUcfA/ F. HfY
Kcf_8UY %&&&%		Kcf_HdY	Gg7cig]5[[f]UY		7cX 65!5;	=gAUcfA/ F. : Ug
@g]hgl'8UY %&#&%		HRUcladyg	%		GfjYXK +	
7cb]hcg D7= -&						
-bg]Vcb7caaYlg						
QádYBi aVf. \$%		HdY	5	5fU	)&'\$\$Gc h	D7= ,&
QádY7caaYlg						
() 89DF9GCB		@		('\$\$ Gc h		
(, @/ H7F		@		% '\$\$: h		
(, @/ H7F		A		\$\$\$: h		
)& F5J9@B;		@		, '\$\$ Gc h		
QádYBi aVf. \$&		HdY	F	5fU	) \$\$\$ \$Gc h	D7= ,(
QádY7caaYlg						
(, @/ H7F		@		* \$\$\$: h		
(, @/ H7F		A		(\$\$\$: h		
) + K95H 9F-B;		@		\$\$\$ \$Gc h		
QádYBi aVf. \$		HdY	F	5fU	) \$\$\$ \$Gc h	D7= , +
QádY7caaYlg						
(, @/ H7F		@		, \$\$\$: h		
(, @/ H7F		A		\$\$ \$: h		
) + K95H 9F-B;		@		\$\$\$ \$Gc h		
QádYBi aVf. \$		HdY	F	5fU	) \$\$\$ \$Gc h	D7= --
QádY7caaYlg						
) + K95H 9F-B;		@		\$\$\$ \$Gc h		
QádYBi aVf. %		HdY	F	5fU	) \$\$\$ \$Gc h	D7= --
QádY7caaYlg						
) + K95H 9F-B;		@		\$\$\$ \$Gc h		
QádYBi aVf. %&		HdY	F	5fU	) \$\$\$ \$Gc h	D7= --
QádY7caaYlg						
) + K95H 9F-B;		@		\$\$\$ \$Gc h		
QádYBi aVf. %		HdY	5	5fU	(* , \$\$\$Gc h	D7= ,(
QádY7caaYlg						
() 89DF9GCB		@		% \$\$\$ Gc h		
) + K95H 9F-B;		@		\$\$\$ \$Gc h		

BYkcf. ; N BláY 9jMfNYbFY]cbU5]fcbBA]XXlab:]YX

GfUW HD% BláY HI]kúúúfUY\$%9jMfNYb I g̃ H5L-K5M 5fU &(ž&Geh

GMfch \$ cZ (: fca. Fibkúúú& H. GMfcb\$ @gh7cbg! %\$\$\$

GfUW 57 : Ua]m 5@SCH57HI]kúúú NcbY 7UH]cfm Fub. D

5fU %ž& Geh @Y[h. &) : h K]Ph.)\$: h

GUg GUV@Y[h. : h GUVK]Ph. : h >ch@Y[h. : h

Gci Xf. GfYWHdY ; fUX \$ @byg \$

GMfcb7caaYlg

Kcf_8UY %%%() Kcf_HdY Bk7cbg]Vcb! :h]U 7cX BI!B =AUcfA/ F. HiY

Kcf_8UY %\$\$\$ Kcf_HdY 7cXA]~&/ &C]Yfm 7cX 7A!C@& =AUcfA/ F. HiY

@gh7cbg!8UY %\$\$\$ HBUcladyg ' GfjYXK '

7cb]cbg D7= ',

-bg]cb7caaYlg

GladyEiaVf. \$% HdY F 5fU *\$-'\$\$Geh D7= '*

Glady7caaYlg

(' 6@C7: 7F @ (, \$\$\$ Geh

(' 6@C7: 7F A '- \$\$\$ Geh

() 89DF9GCB @ ' \$\$\$ Geh

)& F5J9@B; A \$\$\$ Geh

)+ K95H:9F-B; @ \$\$\$ Geh

)+ K95H:9F-B; A \$\$\$ Geh

GladyEiaVf. \$& HdY F 5fU)\$\$\$Geh D7= ('

Glady7caaYlg

(' 6@C7: 7F @ %\$\$\$\$ Geh

(' 6@C7: 7F A \$\$\$\$\$ Geh

() 89DF9GCB @ %\$\$\$\$ Geh

)+ K95H:9F-B; @ \$\$\$\$\$ Geh

)+ K95H:9F-B; A \$\$\$\$\$ Geh

GladyEiaVf. \$ HdY F 5fU)\$-'\$\$Geh D7= '+

Glady7caaYlg

(' 6@C7: 7F @ %\$\$\$\$ Geh

(' 6@C7: 7F A '\$\$\$\$ Geh

() 89DF9GCB @ %\$\$\$\$ Geh

)+ K95H:9F-B; @ \$%'\$\$ Geh

)+ K95H:9F-B; A \$%'\$\$ Geh

BVkf.	; N	BláY	9jMfNYbFY]cbU5]fcbBA]XXlab:]YX
GfUW	HD%	BláY	HI]kúndfUY\$%9jMfNYb I g H5L-K5M 5fU &(ž&Geh
GWfch	\$&	cZ (: fca.	GWfcb\$% H. Filkúny&& @gh7cbgH %4888
GfUW	57	: Ua]m 5@SCH57HI]kúg	NbY 7UH]cfm Fub. D
5fU	% , ž) Geh	@V[h.	'ž&: h K]h.)\$: h
GUg		GU@V[h.	: h GUVK]h. : h >cbh@V[h. : h
Gci Xf.		GfYVHhV	; fUX \$ @bYg \$
GWfcb7caaYlg			
Kcf_8UY %44%)		Kcf_HndY Bk7cbgH Vcb: h]U	7cXV BI !-B =gAUcfA/ F. HfY
Kcf_8UY %4888		Kcf_HndY 7cXA]~&/ &C]YfUm	7cXV 7A!C@& =gAUcfA/ F. HfY
@gh7cbgH'8UY %4488%		HhUcladYg ' %	GfjYhX *
7cbgH]cbg D7= (\$			
-bgH]cb7caaYlg			
GladYBiaVf. \$%		HndY F	5fU)*(,'\$\$Geh D7= '-
GladY7caaYlg			
(' 6@C7: 7F		@	\$8888 Geh
(' 6@C7: 7F		A	'* '\$88 Geh
(, @/ H7F		@	))'\$88 : h
(, @/ H7F		A	\$8888 : h
)+ K95H 9F-B;		@	' \$8888 Geh
)+ K95H 9F-B;		A	%8888 Geh
GladYBiaVf. \$		HndY F	5fU)88888Geh D7= (%'
GladY7caaYlg			
(' 6@C7: 7F		@	)88888 Geh
(' 6@C7: 7F		A	&88888 Geh
(, @/ H7F		A	* '\$88 : h
)+ K95H 9F-B;		@	\$88888 Geh
)+ K95H 9F-B;		A	\$88888 Geh
GladYBiaVf. %		HndY F	5fU)88888Geh D7= ',
GladY7caaYlg			
(' 6@C7: 7F		@	%88888 Geh
(' 6@C7: 7F		A	%88888 Geh
(, @/ H7F		@	%88888 : h
(, @/ H7F		A	(* '\$88 : h
)+ K95H 9F-B;		@	\$88888 Geh
)+ K95H 9F-B;		A	\$88888 Geh
GladYBiaVf. %		HndY F	5fU)88888Geh D7= ',
GladY7caaYlg			
(' 6@C7: 7F		@	%88888 Geh
(' 6@C7: 7F		A	888888 Geh
(, @/ H7F		@	%88888 : h
(, @/ H7F		A	888888 : h
)+ K95H 9F-B;		@	\$88888 Geh
)+ K95H 9F-B;		A	\$88888 Geh
GladYBiaVf. &&		HndY F	5fU)88888Geh D7= (&
GladY7caaYlg			
(' 6@C7: 7F		@	%88888 Geh
(' 6@C7: 7F		A	%88888 Geh
(, @/ H7F		A	&)'88 : h
)+ K95H 9F-B;		@	\$88888 Geh
)+ K95H 9F-B;		A	\$88888 Geh
GladYBiaVf. &		HndY F	5fU)88888Geh D7= (%'
GladY7caaYlg			
(' 6@C7: 7F		A	\$88888 Geh
(, @/ H7F		@	%88888 : h
(, @/ H7F		A	'(,'88 : h

)+ ~~K95H9FB~~
)+ ~~K95H9FB~~

@ ~~QSSS Gh~~
A ~~QSSS Gh~~

BVkf.	; N	BuY	9MfYbFY]cbU5]fcbBA]XXlab:]YX
GfUW	HD&	BuY	HI]kUdUUY'S&9M]fYb I gY H5L-K5M 5fU %&' (G h
GWfch	\$	cZ'	: fca. HI]kUdUUY'S% H. FilkUd&& @]h7cbg' %&()
GfUW	57	: Ua]m	5@SCH57HI]kUg NcbY 7Uf]cfm FUb. D
5fU	%+Z\$ G h	@]h.	'jSS: h K]h.)\$: h
GUg	GUv@]h.	: h	GUvK]h. : h >]h@]h. : h
Gci Xf.	GfYHhY	; fUX	\$ @]h \$
GWfcb7caa Ylg			
Kcf_8UY %&()	Kcf_HdY	Bk7cbg]Vcb:]hU	7cX BI!B =AUcfA/ F. HfY
@]h7cbg'8UY %&+SS%	HRUladYg	')	GfjYhX *
7cb]h7g D7= '-			
=g]h7cb7caa Ylg			
GladYBiaVf. \$	HdY	F	5fU)SS\$G h D7= '+
GladY7caa Ylg			
(' 6@C7? 7F	A	)	SS\$G h
)& F5J9@B;	@	%&S\$G h	
)+ K95H:9F-B;	A	'+)S\$G h	
GladYBiaVf. %	HdY	F	5fU)SS\$G h D7= '+
GladY7caa Ylg			
(' 6@C7? 7F	A	)	SS\$G h
)& F5J9@B;	@	%&S\$G h	
)+ K95H:9F-B;	A	'+)S\$G h	
GladYBiaVf. %	HdY	F	5fU)SS\$G h D7= (&
GladY7caa Ylg			
(' 6@C7? 7F	A	)	SS\$G h
)& F5J9@B;	@	&S\$G h	
)& K95H:9F-B;	A	&)S\$G h	
GladYBiaVf. &	HdY	F	5fU)SS\$G h D7= '+
GladY7caa Ylg			
(' 6@C7? 7F	A	)	SS\$G h
)& F5J9@B;	@	'SS\$G h	
)& K95H:9F-B;	A	(+SS\$G h	
GladYBiaVf. '&	HdY	F	5fU)SS\$G h D7= '+
GladY7caa Ylg			
(' 6@C7? 7F	A	)	SS\$G h
)& F5J9@B;	@	'SS\$G h	
)& K95H:9F-B;	A	(+SS\$G h	
GladYBiaVf. ')	HdY	F	5fU), &'SS\$G h D7= (&
GladY7caa Ylg			
(' 6@C7? 7F57? -B;	A	), &'SS\$G h	
)& K95H:9F-B;	@	%)SS\$G h	
)& K95H:9F-B;	A	(\$, 'SS\$G h	

BYkcf. ; N			BUAY	9jMfNYbFY]cbU5]fcbfBA]XXlab:]YX		
6fUW	HD&&		BUAY	HI]kUnUfUY\$89jMfNYb	IgY	H5L-K5M 5fU
GMfch	%		cZ ' : fca.	FibkUn8&		H. FibkUn8&
GfZUW	57		: Ua]m 5@SCH57HI]kUg	NbY		7UH]cfm
5fU			&Z-' Gc h	@Y[h.	(\$: h	K]Ph.)\$: h
GUg			GU@Y[h.	: h	GUVK]Ph.	: h >ch@Y[h. : h
Gci Xf.			GfYWHdY		; fUX \$	@Uyg \$
GMfcb7caaYlg						
Kcf_8UY %%%()			Kcf_HdY Bk7cbg]Vcb':h]U		7cXV BI!-B	=AUcfA/ F. HfY
@Gj]hg]8UY %#+8%			HRUladYg (		GfjYhX '	
7cb]V]hg D7= '+						
-hg]V]cb7caaYlg						
QladYBiaVf. \$%			HdY F	5fU	)*&'\$\$Gc h	D7= '*
QladY7caaYlg						
(' 6@C7? 7F57?-B;			A	' , &'\$\$ Gc h		
(, @/ H7F			A	- \$\$\$: h		
)\$ D5H<-B;			@	%%\$\$ Gc h		
)+ K95H 9F-B;			@	%&\$\$ Gc h		
)+ K95H 9F-B;			A	%%\$\$ Gc h		
QladYBiaVf. \$			HdY F	5fU	)\$\$\$\$Gc h	D7= '+
QladY7caaYlg						
(' 6@C7? 7F			A	)\$\$\$\$ Gc h		
)+ K95H 9F-B;			@	&\$\$\$\$ Gc h		
)+ K95H 9F-B;			A	&\$\$\$\$ Gc h		
QladYBiaVf. \$			HdY F	5fU	*&'\$\$Gc h	D7= '+
QladY7caaYlg						
(' 6@C7? 7F57?-B;			A	*&'\$\$ Gc h		
)+ K95H 9F-B;			@	'%%\$\$ Gc h		
)+ K95H 9F-B;			A	'%%\$\$ Gc h		

BVkf.	; N	BLAY	9jMfNYbFY]cbU5]fcbfBA]XXlab:]YX				
GfUW	HD&&	BLAY	HI]kUdUUY\$89jMfYb	IgY	H5L-K5M	5fU	8%Z' (Gz h
GMfch	\$&	cZ'	: fca.	FibkUd8%	H.	HI]kUdUUY\$%	@g]7cbg]l' %%%()
GfZUW	57	: Ua]m	5@SCH57HI]kUg	NbY	7U]cfm		Fub. D
5fU		%(Z' &Gz h	@Y]h.	&\$: h	K]Ph.	)\$: h	
GUg		GUv@Y]h.	: h	GUvK]Ph.	: h	>cb]h@Y]h.	: h
Gci Xf.		GfYvHndY		; fUX \$		@Ubg \$	
GMfcb7caa Ylg							
Kcf_8UY %%%()		Kcf_HndY	Bk7cbg]l' Vcb]h]U		7cXV BI!-B		=gAUcfA/ F. HfY
@g]hgl'8UY %%%+8%		HRUcladYg	'		GfjYnX	'	
7cb]hgl' D7= '-							
-hg]hgl'cb7caa Ylg							
QladYBiaVf. \$%		HndY	F	5fU	*% '\$\$ Gz h	D7= '+	
QladY7caa Ylg							
(' 6@C7? 7F57?-B;		A		*% '\$\$ Gz h			
) + K95H 9F-B;		@		' \$ ('\$\$ Gz h			
) + K95H 9F-B;		A		' \$ ('\$\$ Gz h			
QladYBiaVf. \$&		HndY	F	5fU	) \$\$\$ \$ Gz h	D7= ('	
QladY7caa Ylg							
(' 6@C7? 7F		@		& \$\$\$ \$ Gz h			
(' 6@C7? 7F		A		& \$\$\$ \$ Gz h			
) + K95H 9F-B;		@		& \$\$\$ \$ Gz h			
) + K95H 9F-B;		A		& \$\$\$ \$ Gz h			
QladYBiaVf. \$		HndY	F	5fU	') % '\$\$ Gz h	D7= '+	
QladY7caa Ylg							
(' 6@C7? 7F57?-B;		A		') % '\$\$ Gz h			
) + K95H 9F-B;		@		%) - '\$\$ Gz h			
) + K95H 9F-B;		A		%) - '\$\$ Gz h			

APPENDIX E
DISTRESS SUMMARY REPORT



Appendix E
Distress Summary Report
 Evergreen Regional - Middleton Field (GZH)

Branch ID	Section ID	Surface ¹	Area (sf)	Distress Number	Description	Distress Mechanism	Severity	Quantity	Quantity Units	Distress Density
A01	01	AC	20,590	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	805	Ft	3.9%
A01	01	AC	20,590	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	450	Ft	2.2%
A01	01	AC	20,590	50	PATCHING	Climate/Durability	Low	83	SqFt	0.4%
A01	01	AC	20,590	57	WEATHERING	Climate/Durability	Low	10,253	SqFt	49.8%
A01	01	AC	20,590	57	WEATHERING	Climate/Durability	Medium	10,253	SqFt	49.8%
R0119	01	AC	150,000	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	1,340	Ft	0.9%
R0119	01	AC	150,000	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	3,305	Ft	2.2%
R0119	01	AC	150,000	52	RAVELING	Climate/Durability	Low	475	SqFt	0.3%
R0119	01	AC	150,000	57	WEATHERING	Climate/Durability	Low	149,525	SqFt	99.7%
R0119	02	AC	446,250					0		0.0%
R0119	03	AC	132,750					0		0.0%
R1028	01	AC	600,600					0		0.0%
R1028	02	AC	150,000	57	WEATHERING	Climate/Durability	Low	75,000	SqFt	50.0%
T01	01	AC	26,437	43	BLOCK CRACKING	Climate/Durability	Low	3,603	SqFt	13.6%
T01	01	AC	26,437	43	BLOCK CRACKING	Climate/Durability	Medium	13,440	SqFt	50.8%
T01	01	AC	26,437	45	DEPRESSION	Other	Low	564	SqFt	2.1%
T01	01	AC	26,437	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	188	Ft	0.7%
T01	01	AC	26,437	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	939	Ft	3.6%
T01	01	AC	26,437	57	WEATHERING	Climate/Durability	Low	13,219	SqFt	50.0%
T01	01	AC	26,437	57	WEATHERING	Climate/Durability	Medium	13,219	SqFt	50.0%
T02	01	AC	12,365	43	BLOCK CRACKING	Climate/Durability	Low	1,953	SqFt	15.8%
T02	01	AC	12,365	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	252	Ft	2.0%
T02	01	AC	12,365	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	322	Ft	2.6%
T02	01	AC	12,365	57	WEATHERING	Climate/Durability	Low	3,100	SqFt	25.1%

Appendix E
Distress Summary Report
Evergreen Regional - Middleton Field (GZH)

Branch ID	Section ID	Surface ¹	Area (sf)	Distress Number	Description	Distress Mechanism	Severity	Quantity	Quantity Units	Distress Density
T02	01	AC	12,365	57	WEATHERING	Climate/Durability	Medium	3,100	SqFt	25.1%
TC01	01	AC	13,778	43	BLOCK CRACKING	Climate/Durability	Low	2,376	SqFt	17.2%
TC01	01	AC	13,778	43	BLOCK CRACKING	Climate/Durability	Medium	8,409	SqFt	61.0%
TC01	01	AC	13,778	45	DEPRESSION	Other	Low	115	SqFt	0.8%
TC01	01	AC	13,778	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	47	Ft	0.3%
TC01	01	AC	13,778	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	327	Ft	2.4%
TC01	01	AC	13,778	57	WEATHERING	Climate/Durability	Low	9,605	SqFt	69.7%
TC01	01	AC	13,778	57	WEATHERING	Climate/Durability	Medium	3,222	SqFt	23.4%
TC02	01	AC	13,598	43	BLOCK CRACKING	Climate/Durability	Medium	13,598	SqFt	100.0%
TC02	01	AC	13,598	57	WEATHERING	Climate/Durability	Low	6,799	SqFt	50.0%
TC02	01	AC	13,598	57	WEATHERING	Climate/Durability	Medium	6,799	SqFt	50.0%
THANG01	01	AC	27,392	45	DEPRESSION	Other	Low	120	SqFt	0.4%
THANG01	01	AC	27,392	45	DEPRESSION	Other	Medium	60	SqFt	0.2%
THANG01	01	AC	27,392	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	High	35	Ft	0.1%
THANG01	01	AC	27,392	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	745	Ft	2.7%
THANG01	01	AC	27,392	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	985	Ft	3.6%
THANG01	01	AC	27,392	50	PATCHING	Climate/Durability	Low	39	SqFt	0.1%
THANG01	01	AC	27,392	50	PATCHING	Climate/Durability	Medium	39	SqFt	0.1%
THANG01	01	AC	27,392	52	RAVELING	Climate/Durability	High	11	SqFt	0.0%
THANG01	01	AC	27,392	57	WEATHERING	Climate/Durability	Low	13,651	SqFt	49.8%
THANG01	01	AC	27,392	57	WEATHERING	Climate/Durability	Medium	13,651	SqFt	49.8%
TP01	01	AC	69,869	45	DEPRESSION	Other	Low	198	SqFt	0.3%
TP01	01	AC	69,869	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	443	Ft	0.6%
TP01	01	AC	69,869	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	164	Ft	0.2%
TP01	01	AC	69,869	52	RAVELING	Climate/Durability	Low	8	SqFt	0.0%

Appendix E
Distress Summary Report
 Evergreen Regional - Middleton Field (GZH)

Branch ID	Section ID	Surface ¹	Area (sf)	Distress Number	Description	Distress Mechanism	Severity	Quantity	Quantity Units	Distress Density
TP01	01	AC	69,869	57	WEATHERING	Climate/Durability	Low	2,586	SqFt	3.7%
TP01	02	AC	158,755	43	BLOCK CRACKING	Climate/Durability	Low	19,736	SqFt	12.4%
TP01	02	AC	158,755	43	BLOCK CRACKING	Climate/Durability	Medium	68,013	SqFt	42.8%
TP01	02	AC	158,755	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	1,839	Ft	1.2%
TP01	02	AC	158,755	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	8,148	Ft	5.1%
TP01	02	AC	158,755	57	WEATHERING	Climate/Durability	Low	81,584	SqFt	51.4%
TP01	02	AC	158,755	57	WEATHERING	Climate/Durability	Medium	72,519	SqFt	45.7%
TP01	03	AC	16,126	43	BLOCK CRACKING	Climate/Durability	Low	2,881	SqFt	17.9%
TP01	03	AC	16,126	43	BLOCK CRACKING	Climate/Durability	Medium	8,904	SqFt	55.2%
TP01	03	AC	16,126	45	DEPRESSION	Other	Low	230	SqFt	1.4%
TP01	03	AC	16,126	52	RAVELING	Climate/Durability	Medium	22	SqFt	0.1%
TP01	03	AC	16,126	57	WEATHERING	Climate/Durability	Low	7,273	SqFt	45.1%
TP01	03	AC	16,126	57	WEATHERING	Climate/Durability	Medium	7,273	SqFt	45.1%
TP01	04	AC	39,671	43	BLOCK CRACKING	Climate/Durability	Low	4,633	SqFt	11.7%
TP01	04	AC	39,671	43	BLOCK CRACKING	Climate/Durability	Medium	25,192	SqFt	63.5%
TP01	04	AC	39,671	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Low	77	Ft	0.2%
TP01	04	AC	39,671	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	1,236	Ft	3.1%
TP01	04	AC	39,671	57	WEATHERING	Climate/Durability	Low	19,835	SqFt	50.0%
TP01	04	AC	39,671	57	WEATHERING	Climate/Durability	Medium	19,835	SqFt	50.0%
TP02	01	AC	21,793	43	BLOCK CRACKING	Climate/Durability	Medium	19,471	SqFt	89.3%
TP02	01	AC	21,793	48	LONGITUDINAL/TRANSVERSE CRACKING	Climate/Durability	Medium	119	Ft	0.5%
TP02	01	AC	21,793	50	PATCHING	Climate/Durability	Low	2,322	SqFt	10.7%
TP02	01	AC	21,793	57	WEATHERING	Climate/Durability	Low	8,878	SqFt	40.7%
TP02	01	AC	21,793	57	WEATHERING	Climate/Durability	Medium	9,588	SqFt	44.0%
TP02	02	AC	14,632	43	BLOCK CRACKING	Climate/Durability	Low	2,501	SqFt	17.1%
TP02	02	AC	14,632	43	BLOCK CRACKING	Climate/Durability	Medium	12,131	SqFt	82.9%
TP02	02	AC	14,632	57	WEATHERING	Climate/Durability	Low	7,316	SqFt	50.0%

Appendix E
Distress Summary Report
 Evergreen Regional - Middleton Field (GZH)

Branch ID	Section ID	Surface ¹	Area (sf)	Distress Number	Description	Distress Mechanism	Severity	Quantity	Quantity Units	Distress Density
TP02	02	AC	14,632	57	WEATHERING	Climate/Durability	Medium	7,316	SqFt	50.0%
TP02	03	AC	177,309	43	BLOCK CRACKING	Climate/Durability	Medium	177,309	SqFt	100.0%
TP02	03	AC	177,309	52	RAVELING	Climate/Durability	Low	17,830	SqFt	10.1%
TP02	03	AC	177,309	57	WEATHERING	Climate/Durability	Low	23,006	SqFt	13.0%
TP02	03	AC	177,309	57	WEATHERING	Climate/Durability	Medium	136,473	SqFt	77.0%

¹ AC = Asphalt Cement Concrete, AAC = Asphalt Overlay AC, PCC = Portland Cement Concrete, APC = Asphalt Overlay PCC

² LCD = Last construction date. The date of the last major pavement rehabilitation (e.g. AC overlay)

APPENDIX F

INVENTORY

F1: Section Forecasted Pavement Condition Rating

F2: Branch PCI Rating

F3: Branch FOD Rating

Appendix F1
Forecasted Section PCI
Evergreen Regional - Middleton Field (GZH)

Branch ID	Section ID	Forecasted PCI						
		2021	2022	2023	2024	2025	2026	2027
A01	01	63	61	59	57	55	52	50
R0119	01	72	70	70	70	69	64	55
R0119	02	98	97	96	95	94	92	89
R0119	03	98	97	96	95	94	92	89
R1028	01	98	97	96	95	94	92	89
R1028	02	93	91	88	84	81	77	73
T01	01	32	28	25	21	18	14	11
T02	01	61	56	51	47	45	42	38
TC01	01	35	31	28	24	21	17	14
TC02	01	33	29	26	22	19	15	12
THANG01	01	54	50	46	44	41	37	33
TP01	01	89	86	84	81	79	77	75
TP01	02	36	32	29	25	22	18	15
TP01	03	34	30	27	23	20	16	13
TP01	04	35	31	28	24	21	17	14
TP02	01	33	29	26	22	19	15	12
TP02	02	35	31	28	24	21	17	14
TP02	03	35	31	28	24	21	17	14

Pavement Database: ALDOT_Combined_201201

Branch ID	Number of Sections	Sum Section Length (Ft)	Avg Section Width (Ft)	True Area (SqFt)	Use	Average PCI	Standard Deviation PCI	Weighted Average PCI
A01	1	150.00	153.00	20,590.00	APRON	66.00	0.00	66.00
R0119	3	4,860.00	150.00	729,000.00	RUNWAY	91.67	11.79	94.86
R1028	2	5,004.00	150.00	750,600.00	RUNWAY	97.50	2.50	99.00
T01	1	448.00	50.00	26,437.00	TAXIWAY	36.00	0.00	36.00
T02	1	195.00	30.00	12,365.00	TAXIWAY	66.00	0.00	66.00
TC01	1	245.00	50.00	13,778.00	TAXIWAY	39.00	0.00	39.00
TC02	1	255.00	50.00	13,598.00	TAXIWAY	37.00	0.00	37.00
THANG01	1	160.00	135.00	27,392.00	TAXIWAY	60.00	0.00	60.00
TP01	4	5,450.00	50.00	284,421.00	TAXIWAY	52.25	22.96	52.52
TP02	3	4,153.00	50.00	213,734.00	TAXIWAY	38.33	0.94	38.80

Pavement Database: ALDOT_Combined_201201

Use Category	Number of Sections	Total Area (SqFt)	Arithmetic Average PCI	Average STD PCI	Weighted Average PCI
APRON	1	20,590.00	66.00	0.00	66.00
RUNWAY	5	1,479,600.00	94.00	9.70	96.96
TAXIWAY	12	591,725.00	46.83	16.49	46.78
ALL	18	2,091,915.00	61.00	25.40	82.46

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APPENDIX G

SAFETY AND PREVENTIVE MAINTENANCE POLICIES



Appendix G1
Localized Safety (Stopgap) Repair Policy

Distress	Distress Severity	Description	Code	Work Type	Work Unit
41	High	ALLIGATOR CR	PA-FD	Patching - AC Full-Depth	SqFt
43	High	BLOCK CR	CS-AC	Crack Sealing - AC	Ft
45	High	DEPRESSION	PA-FD	Patching - AC Full-Depth	SqFt
47	High	JT REF. CR	CS-AC	Crack Sealing - AC	Ft
48	High	L & T CR	CS-AC	Crack Sealing - AC	Ft
50	High	PATCHING	PA-FD	Patching - AC Full-Depth	SqFt
53	High	RUTTING	PA-FD	Patching - AC Full-Depth	SqFt
54	High	SHOVING	PA-PD	Patching - AC Partial-Depth	SqFt
55	NA	SLIPPAGE CR	PA-PD	Patching - AC Partial-Depth	SqFt
56	High	SWELLING	PA-FD	Patching - AC Full-Depth	SqFt
61	High	BLOW-UP	SL-PC	Slab Replacement - PCC	SqFt
61	Medium	BLOW-UP	PA-PF	Patching - PCC Full Depth	SqFt
62	High	CORNER BREAK	PA-PF	Patching - PCC Full Depth	SqFt
63	High	LINEAR CR	PA-PF	Patching - PCC Full Depth	SqFt
63	Medium	LINEAR CR	CS-PC	Crack Sealing - PCC	Ft
64	High	DURABIL. CR	SL-PC	Slab Replacement - PCC	SqFt
64	Medium	DURABIL. CR	PA-PF	Patching - PCC Full Depth	SqFt
66	High	SMALL PATCH	PA-PP	Patching - PCC Partial Depth	SqFt
67	High	LARGE PATCH	PA-PF	Patching - PCC Full Depth	SqFt
70	High	SCALING	SL-PC	Slab Replacement - PCC	SqFt
71	High	FAULTING	GR-PP	Grinding (Localized)	Ft
72	High	SHAT. SLAB	SL-PC	Slab Replacement - PCC	SqFt
74	High	JOINT SPALL	PA-PP	Patching - PCC Partial Depth	SqFt
75	High	CORNER SPALL	PA-PP	Patching - PCC Partial Depth	SqFt
76	High	ASR	SL-PC	Slab Replacement - PCC	SqFt

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APPENDIX H

M&R UNIT COSTS

H1: M&R Unit Costs

H2: Component Costs for Repair

H3: Airport Category

Maintenance and Repair (M&R) Unit Costs

The M&R costs developed for the ALDOT PMP include costs for maintenance, preservation, and repair activities and are described below.

Unit Costs Source Data

The source for the M&R costs data is RSMMeans, which has data for 14 locations throughout Alabama, as identified by the yellow highlighted boxes in Figure 1. The cost data is presented in terms of individual line items like asphalt wearing course, aggregate base etc., which were consolidated to develop the activity costs described below.

The cost data show a distinct difference in costs between locations north and south of Birmingham, especially for the higher value items like the asphalt layers. Therefore, the unit costs were developed accordingly for the airports north and south of Birmingham, as identified in Figure 1. Appendix H2 presents the component costs used in developing the M&R costs.

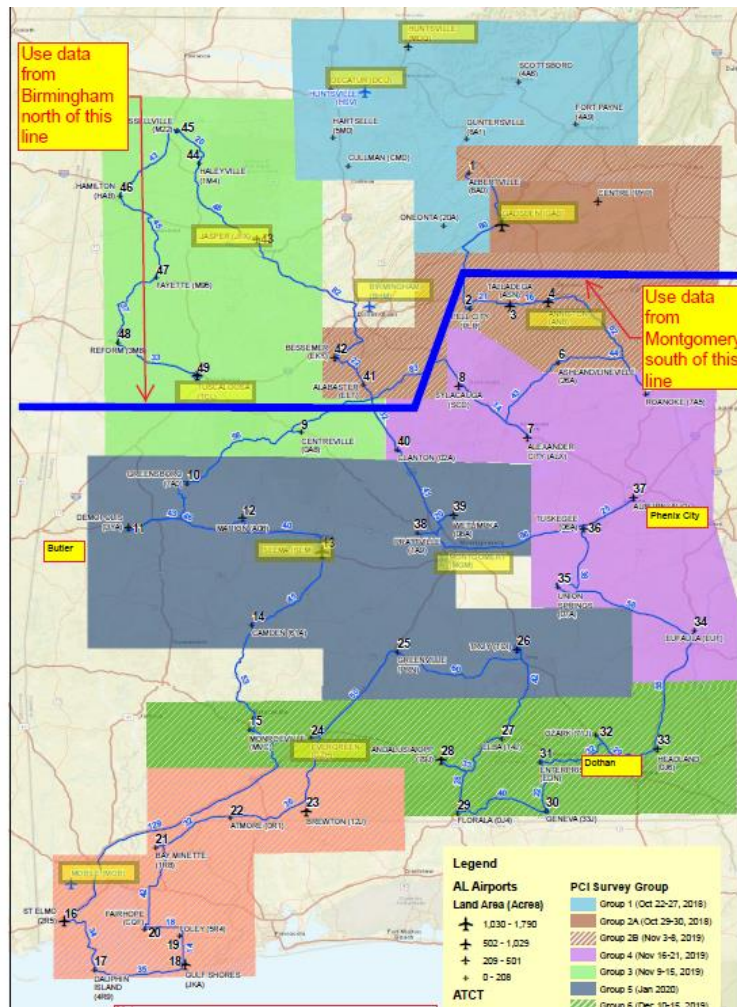


Figure 1: RSMMeans Unit Costs Locations.

Maintenance & Repair (M&R) Activities

Maintenance activities are localized activities which are typically assigned in the first year of the M&R plan based on the observed distresses.

Repair activities are further subdivided into preservation, rehabilitation, and reconstruction. Repair activities are conducted for larger areas, typically at the section level and are assigned based on the importance within the overall network and typically ranges from 55 to 70. The CP was set at 70 for the ALDOT runway pavements and 65 for the other pavements.

Table 1: Repair Activities.

Activity Type	PCI	Activity
Preservation	> CP	Runway Surface Treatment
		Taxiway and Apron Surface Treatment
Rehabilitation	> CP	2" AC OL ¹
	55 - CP	Mill 2" & 2" AC OL
	45 - 55	Mill 2" & 3" AC OL
Reconstruction	0 - 45	Reconstruct with AC

¹For Sections with Structural Distress and PCI greater than Critical PCI

The depths for the milling and overlay (AC OL) in Table 1 were established by creating a balance between removal of surficial distress and providing additional pavement structural capacity. All overlay options include full-depth patching to repair localized distresses.

From the FAA 5010 records, the Alabama airport network includes a wide range of allowable aircraft loads. The airports were divided into three categories of allowable aircraft loads based on requirements for minimum pavement thickness and the use of a P-401 surface layer. The categories are based on the aircraft maximum gross takeoff weight (MGTOW) and include: less than 12,500 lbs, 12,500 to 30,000 lbs, and 30,000 to 100,000 lbs. Appendix H3 presents the category for each airport.

For any sections requiring reconstruction, the pavement sections were established primarily in accordance with the requirements in Section 150/5320-6F. The pavement sections used for developing the cost estimates are:

- < 2,500 lbs 4" h-403 (State HMA Mix) + 6" P-209 Base
- 12,500 - 30,000 lbs 4" h-403 (State HMA Mix) + 8" h-209 Base
- 30,000 - 100,000 lbs 4" h-401 + 10" h-209 Base

It is important to note that while the FAA requires a stabilized base for those pavements that support aircraft operations with MGTOWs that are greater than 100,000 lbs, the number of such operations is minimal for those airports shown in Appendix H3. As a result, the cost of a stabilized base is excluded in

design and aircraft fleet mix development, project-level construction work could include the use of a stabilized base at that time.

M&R Unit Costs

Paving projects typically include additional project costs like mobilization, design, construction administration and inspections, and drainage improvements. A summary of non-direct pavement construction line items has been included in the unit costs in Tables 5 and 6 as described below. These non-direct items are expressed as a percentage of the total component costs for each activity.

These non-APMP project cost estimation. These percentages may vary for Alabama airport construction projects; however, since the direct pavement scope of work is estimated in a network-level evaluation, these conservative estimates serve as a good starting point for the development of realistic total project costs and annual APMP budgets for ALDOT. For repair activities such as Mill & Overlay, which typically do not include significant drainage work, the corresponding multiplier was reduced by 50 percent. The non-direct cost factors are presented in Table 2.

Table 2: Cost Factors.

Factor	Function of	Estimate		
		Preservation	Rehabilitation	Reconstruction
Mobilization	All costs, less design	10%	10%	10%
Drainage Improvements	Paving costs	-	4%	8%
Contingency	All costs, less mobilization and design	10%	20%	20%
Design & CM	All costs, less mobilization and design	15%	20%	20%

The M&R unit costs for maintenance, preservation, and repair activities were developed from the RSMMeans cost data and are presented in the following section.

Maintenance

The maintenance activities include crack seal, and full and partial-depth patching. The unit costs are presented in Table 3.

Table 3: Unit Costs for Maintenance.

Activity	Unit Cost	Unit
Seal Cracks - AC	\$3.95	lf
AC Full-Depth Patching	\$25.05	sf
AC Partial-Dept Patching	\$16.28	sf
Seal Cracks PCC	\$6.00	lf
PCC Full-Depth Patching	\$35.00	sf
PCC Partial-Depth Patching	\$175.00	sf
Jt. Seal	\$8.00	lf
Slab Replacement	\$20.00	sf

Preservation

The unit costs for the surface treatments are presented in Table 4. They include sealing of cracks and application of pavement markings.

Table 4: Unit Costs for Preservation Activities.

Activity	Unit Cost	Unit
Runway Surface Treatment	\$0.57	sf
Taxiway and Apron Surface Treatment	\$0.88	sf

Rehabilitation and Reconstruction

As discussed previously, repair activities are also divided into rehabilitation and reconstruction. The unit costs for airport repair for the Northern Region (Birmingham Area) and Southern Region (Montgomery Area) are shown in Tables 5 and 6, respectively.

Table 5: Unit Costs for Repair Activities, Northern Region.

Activity Type	Activity	MGTOW, thousand lbs		
		2.5	12.5-30	30-100
Rehabilitation	2" AC OL	\$3.78		\$4.19
	Mill 2" & 2" AC OL	\$4.15		\$4.56
	Mill 2" & 3" AC OL	\$5.18		\$5.79
Reconstruction	AC Reconstruction	\$8.40	\$9.10	\$10.91

Table 6: Unit Costs for Repair Activities, Southern Region.

Activity Type	Activity	MGTOW, thousand lbs		
		2.5	12.5-30	30-100
Rehabilitation	2" AC OL	\$3.54		\$3.91
	Mill 2" & 2" AC OL	\$3.90		\$4.27
	Mill 2" & 3" AC OL	\$4.82		\$5.37
Reconstruction	AC Reconstruction	\$7.63	\$8.25	\$9.87

Appendix H2
Component Costs for Repair

Activity Type	Unit	Birmingham (Northern)	Montgomery (Southern)	Comments
Milling 1" to 3"	SY	\$2.08	\$2.01	
Pavement Demolition	SY	\$6.34	\$6.12	
Haulage - For Demolition & AC	CY	\$6.08	\$5.87	
Haulage for 12" Thick Demolition	SY	\$2.03	\$1.96	
Haulage for 2" Thick AC Paving	SY	\$0.34	\$0.33	
Haulage for 3" Thick AC Paving	SY	\$0.51	\$0.49	
Haulage for 4" Thick AC Paving	SY	\$0.68	\$0.65	
AC Wearing Course	Ton	\$97.42	\$86.90	
AC Binder Course	Ton	\$87.80	\$78.17	
P401 - For airports with >60 kip aircraft	Ton	\$116.90	\$104.28	Assumed P401 cost to be 20% greater than AC Wearing Course
6" Aggregate Base (P208)	SY	\$10.17	\$9.12	
8" Aggregate Base (P208)	SY	\$13.29	\$11.89	
6" P209 Aggregate Base	SY	\$12.20	\$10.94	Assumed P209 cost to be 20% greater than P208
8" P209 Aggregate Base	SY	\$15.95	\$14.27	Assumed P209 cost to be 20% greater than P208
10" P209 Aggregate Base	SY	\$19.94	\$17.84	Direct multiplier for 10" from 8"
4" P154 Aggregate Base	SY	\$5.42	\$4.86	Assumed P154 cost to be 20% lower than P208
6" P154 Aggregate Base	SY	\$8.14	\$7.30	Assumed P154 cost to be 20% lower than P208
Pavement Markings	sf	\$1.48	\$1.39	

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APPENDIX I

PAVEMENT CAPITAL IMPROVEMENT PROGRAM

I1: PCIP Summary

I2: Year 1 Maintenance Plan



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Info
Evergreen Regional Airport - Middleton Field (GZH)

Barth & Section	2021	2022	2023	2024	2025	2026	2027
A01-01	Stop Gap \$36651 Before: 6258 After: 6258	Required Project Major Below Critical \$82727 Before: 6037 After: 100	Reventive \$4931 Before: 9779 After: 9779	Reventive \$1018 Before: 9557 After: 9557	Reventive + Required Project Global MR \$1374657 Before: 9836 After: 977	Reventive \$10777 Before: 9558 After: 9558	Reventive \$16651 Before: 9837 After: 9837
R011901	Required Project Major Above Critical \$636854 Before: 7108 After: 10	Reventive \$20526 Before: 987 After: 987	Reventive \$10952 Before: 9748 After: 9748	Reventive \$5888 Before: 9645 After: 9645	Reventive \$78736 Before: 9544 After: 9544	Reventive \$108715 Before: 9416 After: 9416	Reventive \$40605 Before: 9232 After: 9232
T01-01	Stop Gap \$531692 Before: 3052 After: 3052	Stop Gap \$604587 Before: 2698 After: 2698	Required Project Major Below Critical \$285523 Before: 2344 After: 100	Reventive \$3033 Before: 9897 After: 9897	Reventive \$6551 Before: 9785 After: 9785	Reventive + Required Project Global MR \$1756845 Before: 9633 After: 9897	Reventive \$695 Before: 9785 After: 9785
T02-01	Stop Gap \$26077 Before: 593 After: 593	Required Project Major Below Critical \$601345 Before: 5438 After: 10	Reventive \$1365 Before: 9898 After: 9898	Reventive \$2975 Before: 9785 After: 9785	Reventive + Required Project Global MR \$821313 Before: 9633 After: 9897	Reventive \$3156 Before: 9785 After: 9785	Reventive \$5542 Before: 9633 After: 9633

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Evergreen Regional Airport - Middleton Field (GZ)

Barth & Section	2021	2022	2023	2024	2025	2026	2027
TK01-01	Required Project Major Below Critical \$14012226 Before: 3352 After: 101	Reventive \$1477 Before: 9898 After: 9898	Reventive \$3218 Before: 9785 After: 9785	Reventive+ Required Project Global MR \$914999 Before: 9633 After: 9899	Reventive \$3414 Before: 9785 After: 9785	Reventive \$5995 Before: 9633 After: 9633	Reventive \$9476 Before: 9436 After: 9436
TK02-01	Stop Gap \$25086 Before: 3152 After: 3152	Stop Gap \$305377 Before: 2798 After: 2798	Required Project Major Below Critical \$14672242 Before: 2144 After: 101	Reventive \$156 Before: 9897 After: 9897	Reventive \$337 Before: 9785 After: 9785	Reventive+ Required Project Global MR \$908385 Before: 9633 After: 9897	Reventive \$3575 Before: 9785 After: 9785
THANG01-01	Stop Gap \$75275 Before: 5242 After: 5242	Required Project Major Below Critical \$15686048 Before: 48 After: 101	Reventive \$3024 Before: 9898 After: 9898	Reventive \$659 Before: 9785 After: 9785	Reventive \$11571 Before: 9633 After: 9633	Reventive \$1835 Before: 9435 After: 9435	Reventive \$2677 Before: 9199 After: 9199
TF01-01	Reventive+ Required Project Global MR \$8234413 Before: 8796 After: 9532	Reventive \$50611 Before: 9312 After: 9312	Reventive \$71136 Before: 9061 After: 9061	Reventive \$9891 Before: 8796 After: 8796	Reventive \$117768 Before: 8535 After: 8535	Reventive \$141619 Before: 8289 After: 8289	Reventive \$164934 Before: 8065 After: 8065
TF01-02	Required Project Major Below Critical \$161453835 Before: 3452 After: 100	Reventive \$17014 Before: 9898 After: 9898	Reventive \$37083 Before: 9785 After: 9785	Reventive+ Required Project Global MR \$1054294 Before: 9633 After: 9899	Reventive \$38842 Before: 9785 After: 9785	Reventive \$68076 Before: 9633 After: 9633	Reventive \$109187 Before: 9436 After: 9436

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Evergreen Regional Airport - Middleton Field (GZ)

Barth & Section	2021	2022	2023	2024	2025	2026	2027
TF01-03	Required Project Major Below Critical \$161001.42 Before: 3252 After: 100	Revertive \$1728 Before: 9898 After: 9898	Revertive \$3767 Before: 9785 After: 9785	Revertive+ Required Project Global MR \$107093 Before: 9633 After: 9899	Revertive \$3996 Before: 9785 After: 9785	Revertive \$7017 Before: 9633 After: 9633	Revertive \$11091 Before: 9436 After: 9436
TF01-04	Required Project Major Below Critical \$1085407 Before: 3352 After: 100	Revertive \$4252 Before: 9898 After: 9898	Revertive \$9267 Before: 9785 After: 9785	Revertive+ Required Project Global MR \$2634556 Before: 9633 After: 9899	Revertive \$9831 Before: 9785 After: 9785	Revertive \$17261 Before: 9633 After: 9633	Revertive \$27285 Before: 9436 After: 9436
TF02-01	Stop Gap \$101242 Before: 3152 After: 3152	Stop Gap \$489417 Before: 2798 After: 2798	Required Project Major Below Critical \$23514647 Before: 2144 After: 100	Revertive \$25 Before: 9897 After: 9897	Revertive \$5401 Before: 9785 After: 9785	Revertive+ Required Project Global MR \$144782 Before: 9633 After: 9899	Revertive \$573 Before: 9785 After: 9785
TF02-02	Stop Gap \$219645 Before: 3352 After: 3352	Stop Gap \$316557 Before: 2998 After: 2998	Required Project Major Below Critical \$15787928 Before: 2644 After: 100	Revertive \$1679 Before: 9897 After: 9897	Revertive \$3626 Before: 9785 After: 9785	Revertive+ Required Project Global MR \$972079 Before: 9633 After: 9899	Revertive \$3847 Before: 9785 After: 9785

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Evergreen Regional Airport - Middleton Field (GZ)

Barth & Section	2021	2022	2023	2024	2025	2026	2027
TR0203	Stop Cap \$2661634 Before: 3352 After: 3352	Stop Cap \$3886006 Before: 2998 After: 2998	Required Project Major Below Critical \$191316411 Before: 2644 After: 100	Revertive \$2034 Before: 9897 After: 9897	Revertive \$4394 Before: 9785 After: 9785	Revertive + Required Project Global MR \$11779543 Before: 9633 After: 9897	Revertive \$46616 Before: 9785 After: 9785

Appendix I2
Localized Maintenance Plan
Evergreen Regional Airport - Middleton Field (GZH)

Branch ID	Section ID	Policy	Distress Code	Description	Severity	Distress Qty	Distress Unit	Percent Distress	Work Description	Work Qty	Work Unit	Unit Cost	Work Cost
A01	01	Preventive	48	L & T CR	Low	805	Ft	3.91	No Localized M & R	0		\$0.00	\$0
A01	01	Preventive	50	PATCHING	Low	83	SqFt	0.41	No Localized M & R	0		\$0.00	\$0
A01	01	Preventive	48	L & T CR	Medium	450	Ft	2.19	Crack Sealing - AC	450	Ft	\$3.95	\$1,777
A01	01	Preventive	57	WEATHERING	Low	10,253	SqFt	49.79	No Localized M & R	0		\$0.00	\$0
A01	01	Preventive	57	WEATHERING	Medium	10,253	SqFt	49.79	No Localized M & R	0		\$0.00	\$0
T01	01	Safety	57	WEATHERING	Low	13,219	SqFt	50	No Localized M & R	0		\$0.00	\$0
T01	01	Safety	45	DEPRESSION	Low	563	SqFt	2.13	No Localized M & R	0		\$0.00	\$0
T01	01	Safety	43	BLOCK CR	Medium	13,440	SqFt	50.84	No Localized M & R	0		\$0.00	\$0
T01	01	Safety	57	WEATHERING	Medium	13,219	SqFt	50	No Localized M & R	0		\$0.00	\$0
T01	01	Safety	48	L & T CR	Medium	939	Ft	3.55	No Localized M & R	0		\$0.00	\$0
T01	01	Safety	43	BLOCK CR	Low	3,603	SqFt	13.63	No Localized M & R	0		\$0.00	\$0
T01	01	Safety	48	L & T CR	Low	188	Ft	0.71	No Localized M & R	0		\$0.00	\$0
T02	01	Safety	57	WEATHERING	Medium	3,100	SqFt	25.07	No Localized M & R	0		\$0.00	\$0
T02	01	Safety	57	WEATHERING	Low	3,100	SqFt	25.07	No Localized M & R	0		\$0.00	\$0
T02	01	Safety	43	BLOCK CR	Low	1,953	SqFt	15.79	No Localized M & R	0		\$0.00	\$0
T02	01	Safety	48	L & T CR	Low	252	Ft	2.04	No Localized M & R	0		\$0.00	\$0
T02	01	Safety	48	L & T CR	Medium	322	Ft	2.61	No Localized M & R	0		\$0.00	\$0
TC01	01	Safety	57	WEATHERING	Low	9,606	SqFt	69.72	No Localized M & R	0		\$0.00	\$0
TC01	01	Safety	45	DEPRESSION	Low	115	SqFt	0.83	No Localized M & R	0		\$0.00	\$0
TC01	01	Safety	43	BLOCK CR	Low	2,376	SqFt	17.24	No Localized M & R	0		\$0.00	\$0
TC01	01	Safety	43	BLOCK CR	Medium	8,409	SqFt	61.03	No Localized M & R	0		\$0.00	\$0
TC01	01	Safety	48	L & T CR	Medium	327	Ft	2.37	No Localized M & R	0		\$0.00	\$0
TC01	01	Safety	57	WEATHERING	Medium	3,222	SqFt	23.39	No Localized M & R	0		\$0.00	\$0
TC01	01	Safety	48	L & T CR	Low	47	Ft	0.34	No Localized M & R	0		\$0.00	\$0
TC02	01	Safety	57	WEATHERING	Medium	6,799	SqFt	50	No Localized M & R	0		\$0.00	\$0
TC02	01	Safety	43	BLOCK CR	Medium	13,598	SqFt	100	No Localized M & R	0		\$0.00	\$0
TC02	01	Safety	57	WEATHERING	Low	6,799	SqFt	50	No Localized M & R	0		\$0.00	\$0
THANG01	01	Safety	52	RAVELING	High	11	SqFt	0.04	No Localized M & R	0		\$0.00	\$0
THANG01	01	Safety	45	DEPRESSION	Medium	60	SqFt	0.22	No Localized M & R	0		\$0.00	\$0

Appendix I2
Localized Maintenance Plan
Evergreen Regional Airport - Midleton Field (GZH)

Branch ID	Section ID	Policy	Distress Code	Description	Severity	Distress Qty	Distress Unit	Percent Distress	Work Description	Work Qty	Work Unit	Unit Cost	Work Cost
THANG01	01	Safety	50	PATCHING	Low	39	SqFt	0.14	No Localized M & R	0		\$0.00	\$0
THANG01	01	Safety	48	L & T CR	Medium	985	Ft	3.6	No Localized M & R	0		\$0.00	\$0
THANG01	01	Safety	45	DEPRESSION	Low	120	SqFt	0.44	No Localized M & R	0		\$0.00	\$0
THANG01	01	Safety	48	L & T CR	High	35	Ft	0.13	Crack Sealing - AC	35	Ft	\$3.95	\$138
THANG01	01	Safety	57	WEATHERING	Low	13,651	SqFt	49.84	No Localized M & R	0		\$0.00	\$0
THANG01	01	Safety	57	WEATHERING	Medium	13,651	SqFt	49.84	No Localized M & R	0		\$0.00	\$0
THANG01	01	Safety	50	PATCHING	Medium	39	SqFt	0.14	No Localized M & R	0		\$0.00	\$0
THANG01	01	Safety	48	L & T CR	Low	745	Ft	2.72	No Localized M & R	0		\$0.00	\$0
TP01	01	Preventive	52	RAVELING	Low	8	SqFt	0.01	No Localized M & R	0		\$0.00	\$0
TP01	01	Preventive	48	L & T CR	Medium	164	Ft	0.23	Crack Sealing - AC	164	Ft	\$3.95	\$649
TP01	01	Preventive	48	L & T CR	Low	443	Ft	0.63	No Localized M & R	0		\$0.00	\$0
TP01	01	Preventive	45	DEPRESSION	Low	198	SqFt	0.28	Patching - AC Full-Depth	258	SqFt	\$25.05	\$6,479
TP01	01	Preventive	57	WEATHERING	Low	2,586	SqFt	3.7	No Localized M & R	0		\$0.00	\$0
TP01	02	Safety	57	WEATHERING	Medium	72,519	SqFt	45.68	No Localized M & R	0		\$0.00	\$0
TP01	02	Safety	57	WEATHERING	Low	81,584	SqFt	51.39	No Localized M & R	0		\$0.00	\$0
TP01	02	Safety	43	BLOCK CR	Low	19,736	SqFt	12.43	No Localized M & R	0		\$0.00	\$0
TP01	02	Safety	43	BLOCK CR	Medium	68,013	SqFt	42.84	No Localized M & R	0		\$0.00	\$0
TP01	02	Safety	48	L & T CR	Medium	8,148	Ft	5.13	No Localized M & R	0		\$0.00	\$0
TP01	02	Safety	48	L & T CR	Low	1,839	Ft	1.16	No Localized M & R	0		\$0.00	\$0
TP01	03	Safety	52	RAVELING	Medium	22	SqFt	0.14	No Localized M & R	0		\$0.00	\$0
TP01	03	Safety	57	WEATHERING	Low	7,273	SqFt	45.1	No Localized M & R	0		\$0.00	\$0
TP01	03	Safety	45	DEPRESSION	Low	230	SqFt	1.43	No Localized M & R	0		\$0.00	\$0
TP01	03	Safety	43	BLOCK CR	Low	2,881	SqFt	17.87	No Localized M & R	0		\$0.00	\$0
TP01	03	Safety	43	BLOCK CR	Medium	8,904	SqFt	55.22	No Localized M & R	0		\$0.00	\$0
TP01	03	Safety	57	WEATHERING	Medium	7,273	SqFt	45.1	No Localized M & R	0		\$0.00	\$0
TP01	04	Safety	48	L & T CR	Low	77	Ft	0.19	No Localized M & R	0		\$0.00	\$0
TP01	04	Safety	43	BLOCK CR	Medium	25,192	SqFt	63.5	No Localized M & R	0		\$0.00	\$0
TP01	04	Safety	57	WEATHERING	Low	19,835	SqFt	50	No Localized M & R	0		\$0.00	\$0
TP01	04	Safety	48	L & T CR	Medium	1,236	Ft	3.11	No Localized M & R	0		\$0.00	\$0

Appendix I2
Localized Maintenance Plan
Evergreen Regional Airport - Midleton Field (GZH)

Branch ID	Section ID	Policy	Distress Code	Description	Severity	Distress Qty	Distress Unit	Percent Distress	Work Description	Work Qty	Work Unit	Unit Cost	Work Cost
TP01	04	Safety	43	BLOCK CR	Low	4,633	SqFt	11.68	No Localized M & R	0		\$0.00	\$0
TP01	04	Safety	57	WEATHERING	Medium	19,835	SqFt	50	No Localized M & R	0		\$0.00	\$0
TP02	01	Safety	43	BLOCK CR	Medium	19,471	SqFt	89.34	No Localized M & R	0		\$0.00	\$0
TP02	01	Safety	50	PATCHING	Low	2,322	SqFt	10.66	No Localized M & R	0		\$0.00	\$0
TP02	01	Safety	57	WEATHERING	Medium	9,588	SqFt	43.99	No Localized M & R	0		\$0.00	\$0
TP02	01	Safety	48	L & T CR	Medium	119	Ft	0.54	No Localized M & R	0		\$0.00	\$0
TP02	01	Safety	57	WEATHERING	Low	8,878	SqFt	40.74	No Localized M & R	0		\$0.00	\$0
TP02	02	Safety	57	WEATHERING	Low	7,316	SqFt	50	No Localized M & R	0		\$0.00	\$0
TP02	02	Safety	43	BLOCK CR	Low	2,501	SqFt	17.09	No Localized M & R	0		\$0.00	\$0
TP02	02	Safety	57	WEATHERING	Medium	7,316	SqFt	50	No Localized M & R	0		\$0.00	\$0
TP02	02	Safety	43	BLOCK CR	Medium	12,131	SqFt	82.91	No Localized M & R	0		\$0.00	\$0
TP02	03	Safety	57	WEATHERING	Low	23,006	SqFt	12.98	No Localized M & R	0		\$0.00	\$0
TP02	03	Safety	57	WEATHERING	Medium	136,473	SqFt	76.97	No Localized M & R	0		\$0.00	\$0
TP02	03	Safety	52	RAVELING	Low	17,830	SqFt	10.06	No Localized M & R	0		\$0.00	\$0
TP02	03	Safety	43	BLOCK CR	Medium	177,309	SqFt	100	No Localized M & R	0		\$0.00	\$0