Alabama Statewide Airport Pavement Management Program Update

Hartselle-Morgan County Regional Airport

Final Report

February 2022

Submitted to

Alabama Department of Aeronautics

Submitted by

JVIATION

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

ALABAMA STATEWIDE AIRPORT PAVEMENT MANAGEMENT PROGRAM UPDATE

Hartselle-Morgan County Regional Airport (5M0)

FINAL REPORT

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February 2022

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Executive Summary

The Jviation 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 Hartselle-Morgan County Regional Airport (5M0).

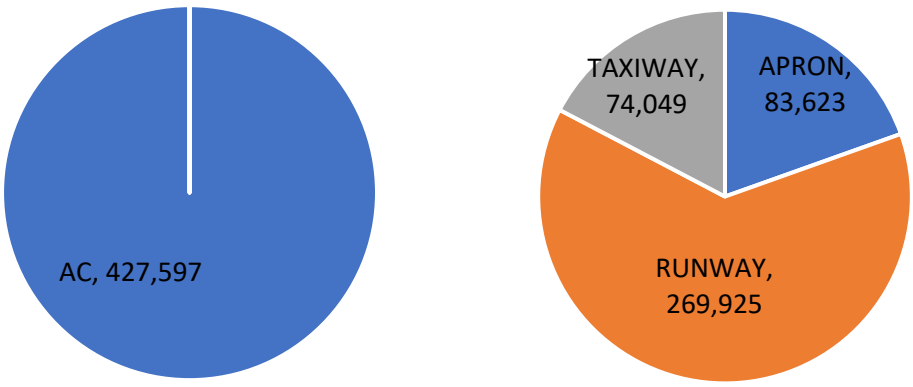
The following APMP tasks were completed to achieve the project objectives at 5M0:

- 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 8 branches and 11 sections within 5M0's pavement network with a total surface area of approximately 0.43 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 October 2018 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 5M0 pavement network is 67, representing a "Fair" condition. The network area-weighted pavement age (AW Age) is 18 years.

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

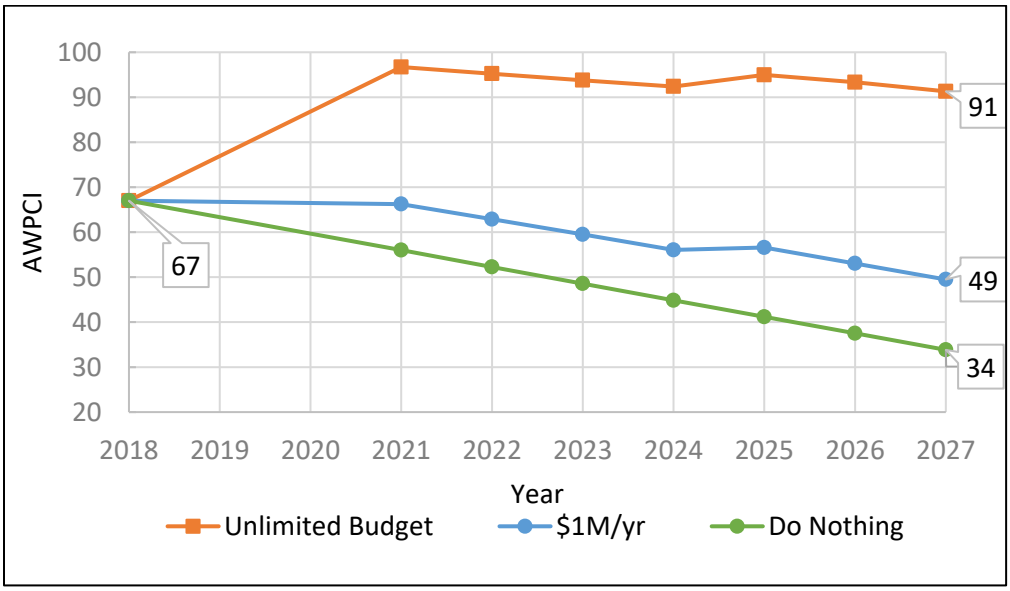
Table ES-1: 5M0 Section PCI Values and Ratings.

Branch ID	Name	Section ID	Surface	Area (sf)	PCI	PCI Category
A01	Apron 01	01	AC	46,877	77	Satisfactory
A01	Apron 01	02	AC	36,746	58	Fair
R1836	Runway 18-36	01	AC	269,925	66	Fair
TC01	Taxiway Connector 01	01	AC	6,760	50	Poor
TC02	Taxiway Connector 02	01	AC	9,027	68	Fair
THANG01	Taxiway Hangar 01	01	AC	10,481	63	Fair
THANG01	Taxiway Hangar 01	02	AC	7,476	60	Fair
THANG02	Taxiway Hangar 02	01	AC	11,954	71	Satisfactory
THANG02	Taxiway Hangar 02	02	AC	17,279	98	Good
TTRW18	Taxiway Turnaround RW18	01	AC	5,485	60	Fair
TTRW36	Taxiway Turnaround RW36	01	AC	5,587	54	Poor

ES.3 Pavement Maintenance and Repair Funding Levels

The PAVER database was updated with 2018 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 5M0 network PCI values for each funding level.

Figure ES-2: M&R Funding Levels.



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 $2.5 million. These recommendations are based on a network-level evaluation. Project-level evaluations should be conducted prior to developing design and bid package documents.

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

Project Year	CIP Project	Total Project Cost	Total Project Area, sf	AWPCI Before	AWPCI After
2024	5M0_24-01_Runway 18-36 Rehabilitation	$1,784,785	296,784	64	100
2025	5M0_25-01_Apron Rehabilitation	$681,794	101,580	59	100
	Total	**$2,466,580**			

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 $12,534 as summarized in Table ES-3.

Table ES-3: Summary of Localized Maintenance Plan.

Policy	Work Description	Work Quantity	Work Unit	Work Cost
Preventive	Crack Sealing - AC	1,237	Ft	$4,888
	Patching - AC Full-Depth	305	SqFt	$7,647
			Total	**$12,534**

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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 72 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 Jviation Inc. (Jviation) 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 airports, which was conducted by All About Pavements, Inc., (API), a Jviation 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 Hartselle-Morgan County Regional Airport (5M0), 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 72 public use 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 5M0 report will be one of the 59 individual airport reports that will be available on ALDOT's website.

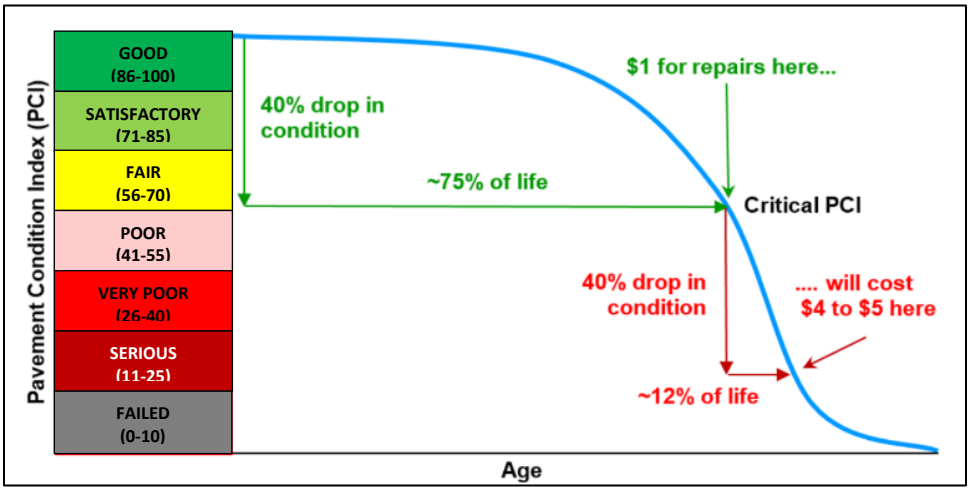
1.3. Pavement Management Concept

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

5M0 is a General Aviation (GA) airport located approximately 2 miles south of Hartselle. The airport was activated in September 1965 and is owned and operated by the City of Hartselle. Figure 2.1 shows an aerial image of the airport.

Figure 2.1: Hartselle-Morgan County Regional Airport.

(Source: Google Earth)

2.2. Pavement Inventory

5M0 consists of one runway, a parallel taxiway, two connector taxiways, and an apron. The total pavement area is approximately 0.43 million square feet. All pavements at 5M0 are Asphalt Concrete (AC) surfaced. A complete listing of the pavement sections is included in Appendix A. Runway 18-36 is 3,599 ft. long and 75 ft. wide.

A records search was undertaken to identify any preservation or rehabilitation work that has occurred at 5M0 since the last APMP update in 2009. The records for "Airfield Pavement Rejuvenation and Marking" from 2010 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 5M0. As the table shows, the pavements at 5M0 are exposed to freeze-thaw cycles from December to February. The mean air temperature for January ranges from an average low of 29 degrees ^{o}F to an average high of 50 degrees ^{o}F. The average annual rainfall at 5M0 is near 56 inches.

Table 2.1: Average Annual Temperatures and Rainfall for 5M0.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Temp (°F)	50	55	64	72	79	87	90	90	84	74	63	53
Low Temp (°F)	29	32	39	46	55	63	68	66	60	47	39	32
Precip. (in)	5.2	4.5	6.5	5.1	4.5	4.3	4.3	3.9	4.4	3.3	4.6	4.9

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 5M0 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 5M0.

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 5M0.

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 8 branches (facilities) at 5M0 that include 11 pavement sections and a total area of approximately 0.43 million square feet of paved surfaces, as shown in Table 2.3.

Table 2.3: 5M0 Pavement Branches.

Branch ID	Branch Name	Branch Use	Area, sf	Number of Sections
A01	Apron 01	APRON	83,623	2
R1836	Runway 18-36	RUNWAY	269,925	1
TC01	Taxiway Connector 01	TAXIWAY	6,760	1
TC02	Taxiway Connector 02	TAXIWAY	9,027	1
THANG01	Taxiway Hangar 01	TAXIWAY	17,957	2
THANG02	Taxiway Hangar 02	TAXIWAY	29,233	2
TTRW18	Taxiway Turnaround RW18	TAXIWAY	5,485	1
TTRW36	Taxiway Turnaround RW36	TAXIWAY	5,587	1
		Total	**427,597**	**11**

Table 2.4 shows the distribution of airfield pavement by age with the area-weighted age being 18 years for all airside pavements at 5M0.

Table 2.4: 5M0 Pavement Age.

Age (Years)	Number of Sections	Percent of Area	Area, sf
0 – 5	0	0	0
6 – 10	1	4	17,279
11 – 15	1	11	46,877
16 – 20	7	75	319,935
> 20	2	10	43,506

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: 5M0 Pavement Area by Surface Type.

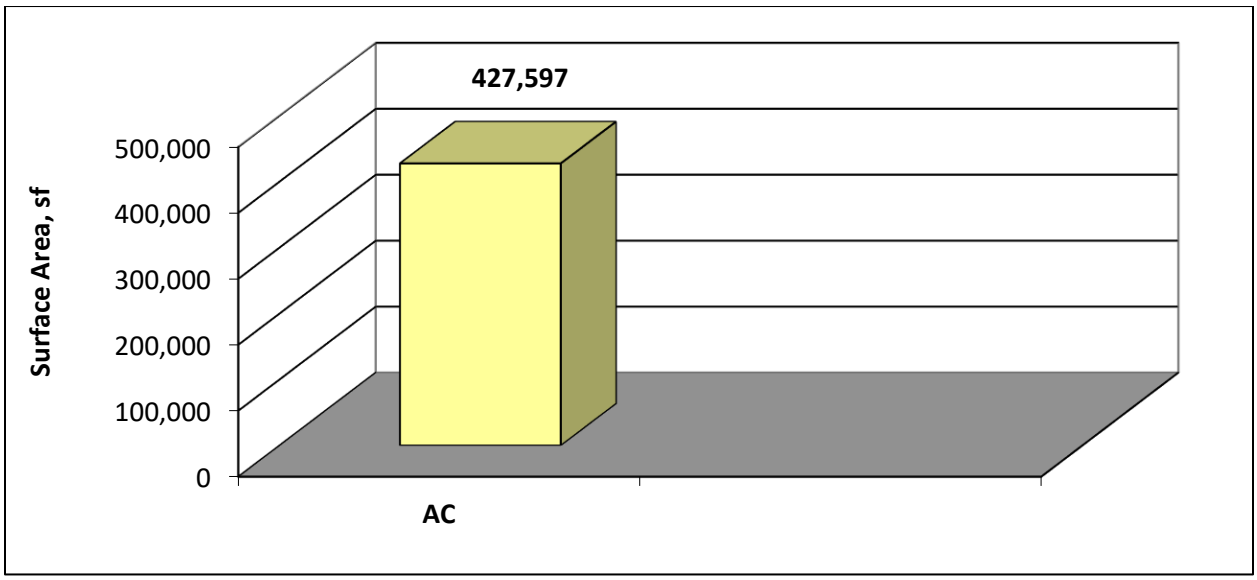
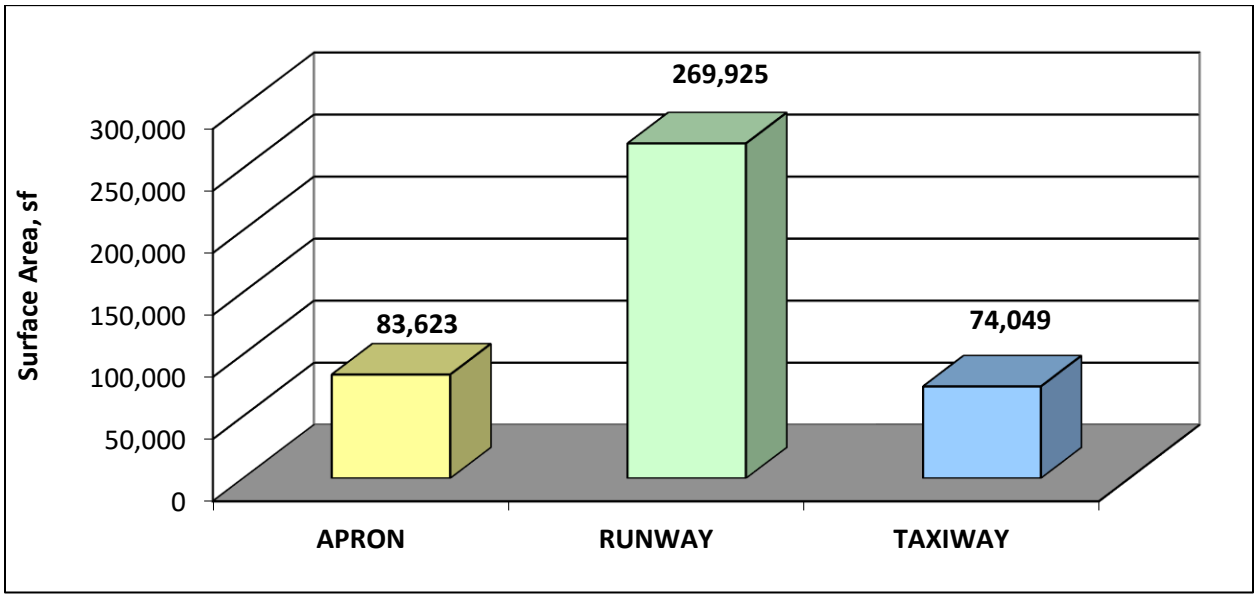


Figure 2.3: 5M0 Pavement Area by Branch Use.



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 5M0 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 October 2018 by a two 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	GOOD: Pavement has minor or no distresses and should require only routine maintenance.
			71-85	SATISFACTORY: Pavement has scattered low-severity distresses that should require only routine maintenance.
FAIR			56-70	FAIR: 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	POOR: 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	VERY POOR: Pavement has predominantly medium- and high-severity distresses that cause considerable maintenance & operational problems. Near-term M&R needs will be major.
			11-25	SERIOUS: Pavement has mainly high-severity distresses that cause operational restrictions; immediate repairs are needed.
			0-10	FAILED: 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.

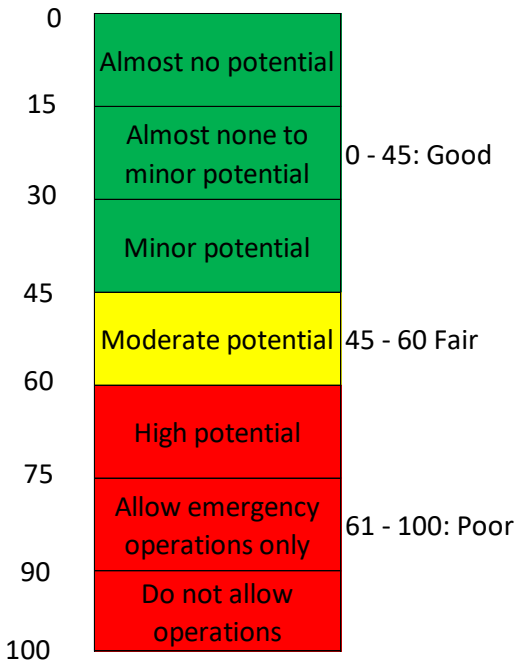
Distress descriptions provided in Appendix C were taken from the "PCI Field Manual," developed by the U.S. Army Construction Engineering Research Lab (CERL), latest edition. Appendix C provides a detailed explanation of each type of AC and PCC surface distress.

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 5M0 include 11 sections with 86 sample units. The sample number of sample units that were surveyed in the field is 28, which is 33 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.

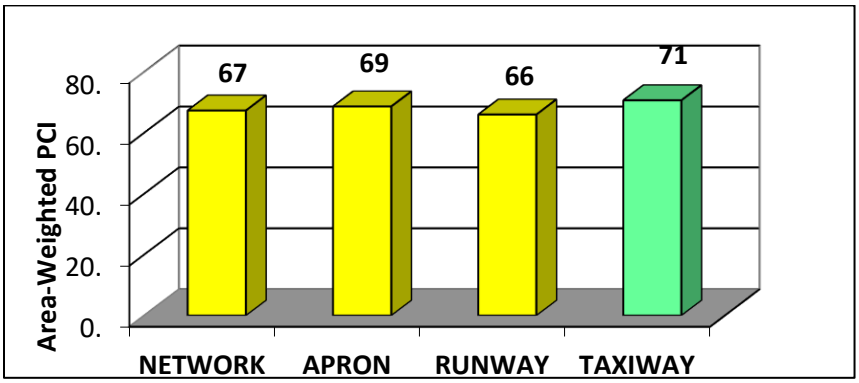


Figure 3.3 shows the distribution of the 5M0 pavement network by condition. Approximately 3 percent of the network is in "Poor" or worse condition.

Figure 3.3: Pavement Condition by Percent of Area.

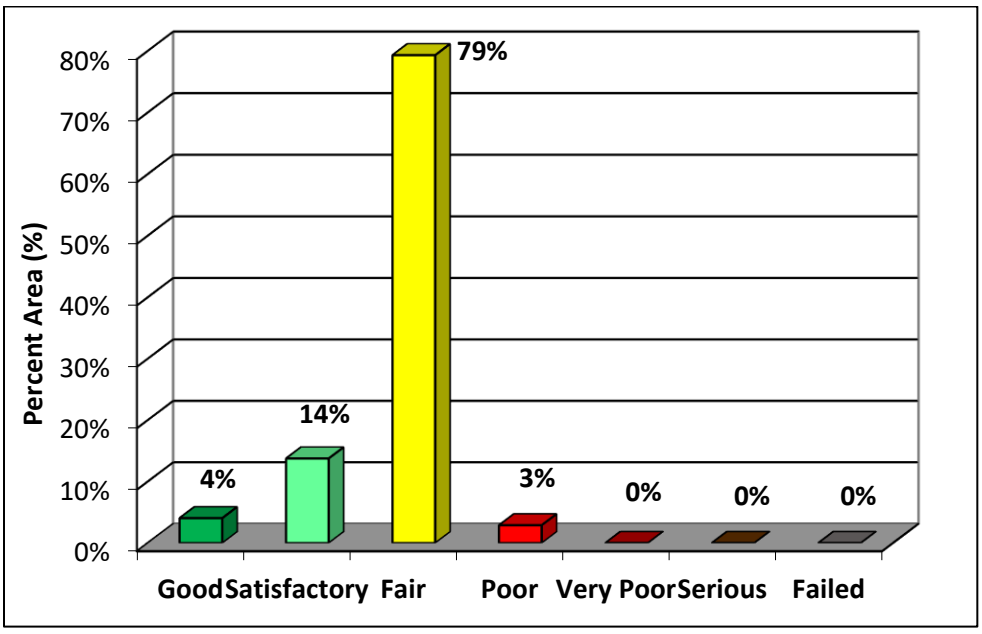


Table 3.2 is a listing of the section PCI.

Table 3.2: Section PCI.

Branch ID	Name	Section ID	Surface	Area (sf)	PCI	PCI Category	FOD
A01	Apron 01	01	AC	46,877	77	Satisfactory	35
A01	Apron 01	02	AC	36,746	58	Fair	57
R1836	Runway 18-36	01	AC	269,925	66	Fair	48
TC01	Taxiway Connector 01	01	AC	6,760	50	Poor	65
TC02	Taxiway Connector 02	01	AC	9,027	68	Fair	46
THANG01	Taxiway Hangar 01	01	AC	10,481	63	Fair	51
THANG01	Taxiway Hangar 01	02	AC	7,476	60	Fair	51
THANG02	Taxiway Hangar 02	01	AC	11,954	71	Satisfactory	42
THANG02	Taxiway Hangar 02	02	AC	17,279	98	Good	11
TTRW18	Taxiway Turnaround RW18	01	AC	5,485	60	Fair	54
TTRW36	Taxiway Turnaround RW36	01	AC	5,587	54	Poor	61

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 rating for the PCC aprons at 5M0.

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.

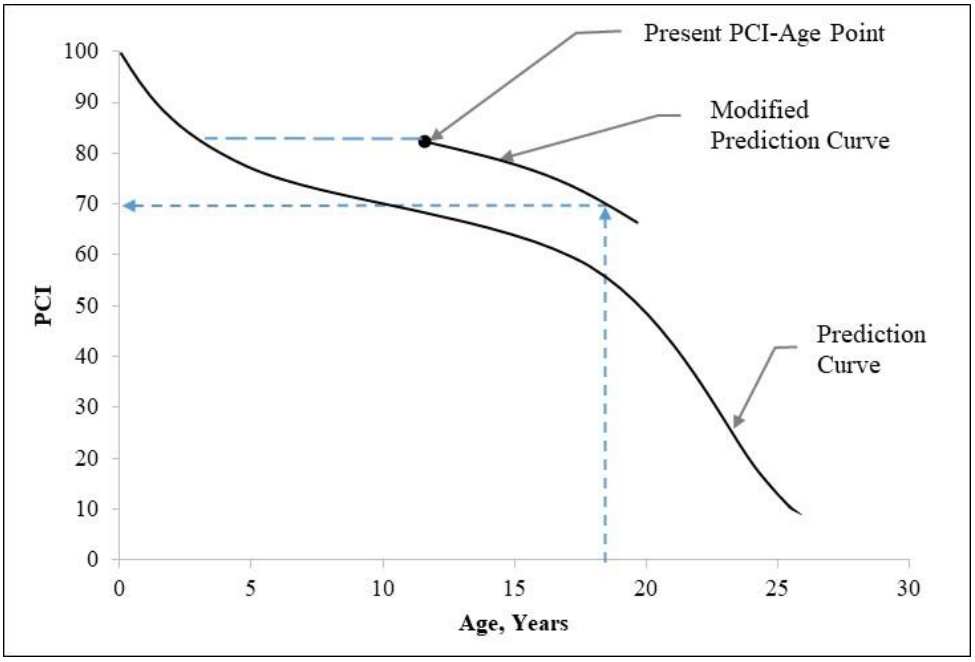
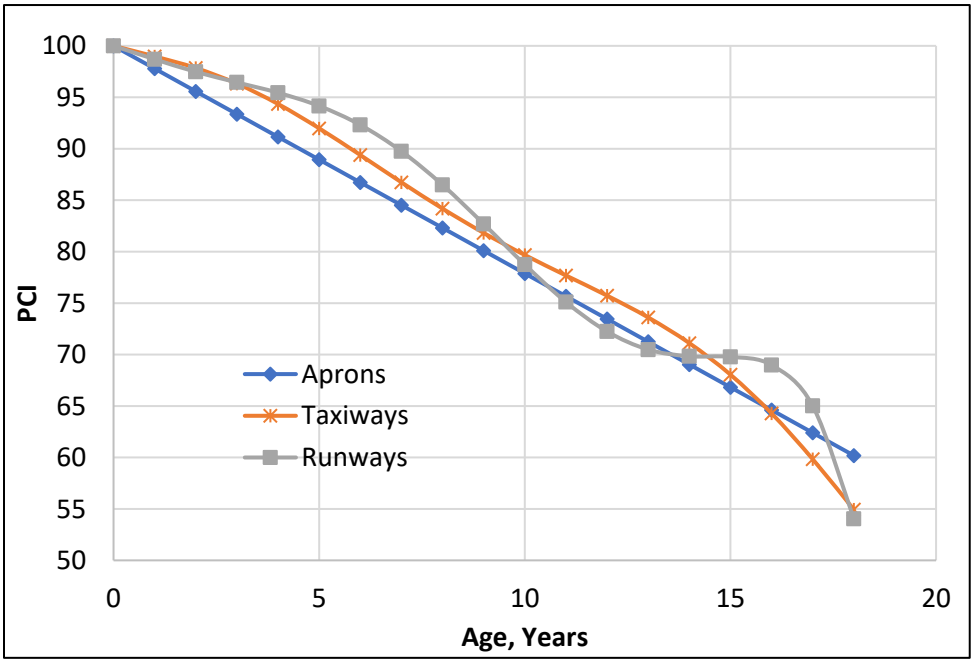


Figure 4.2: Family Curves.



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]	$3.78
	55 - CP	Mill 2" & 2" AC OL	$4.15
	45 - 55	Mill 2" & 3" AC OL	$5.18
Reconstruction	0 - 45	AC Reconstruction	$9.10

[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 5M0 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 91 by 2027.
- Maintain PCI: PAVER could not iterate for this condition and this funding level is therefore excluded.
- Constrained Funding: This scenario constrains the funding to $1 million each year (total of $7 million). The PCI decreases to 49 in 2027.
- Do Nothing: Performing no M&R would reduce the network PCI from 67 to 34 by 2027.

Figure 4.3: Budget Analysis Process.

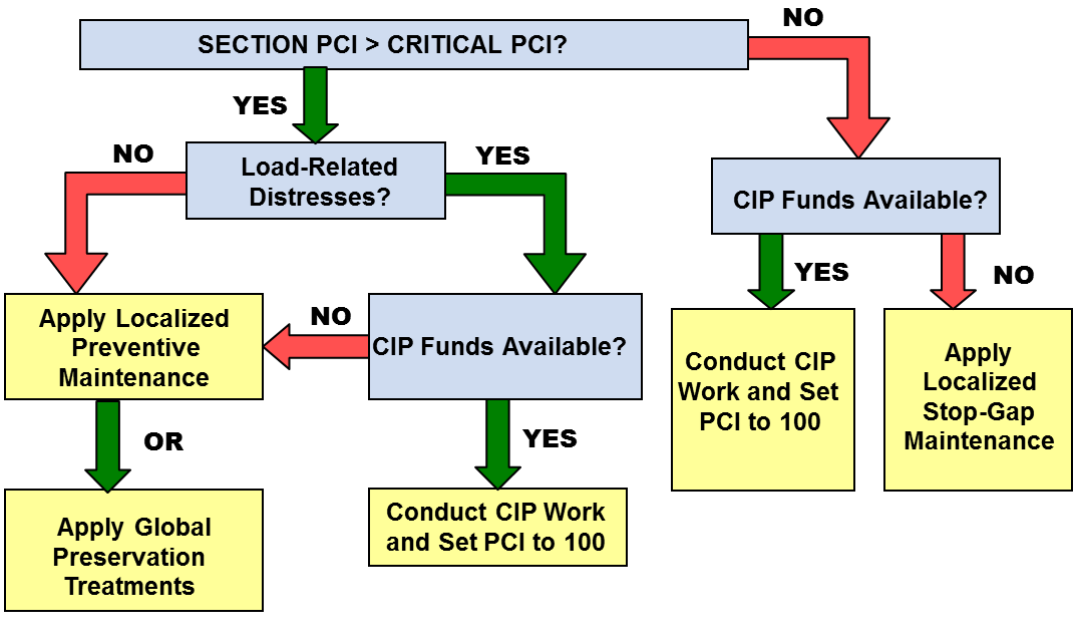


Figure 4.4: M&R Funding Levels.

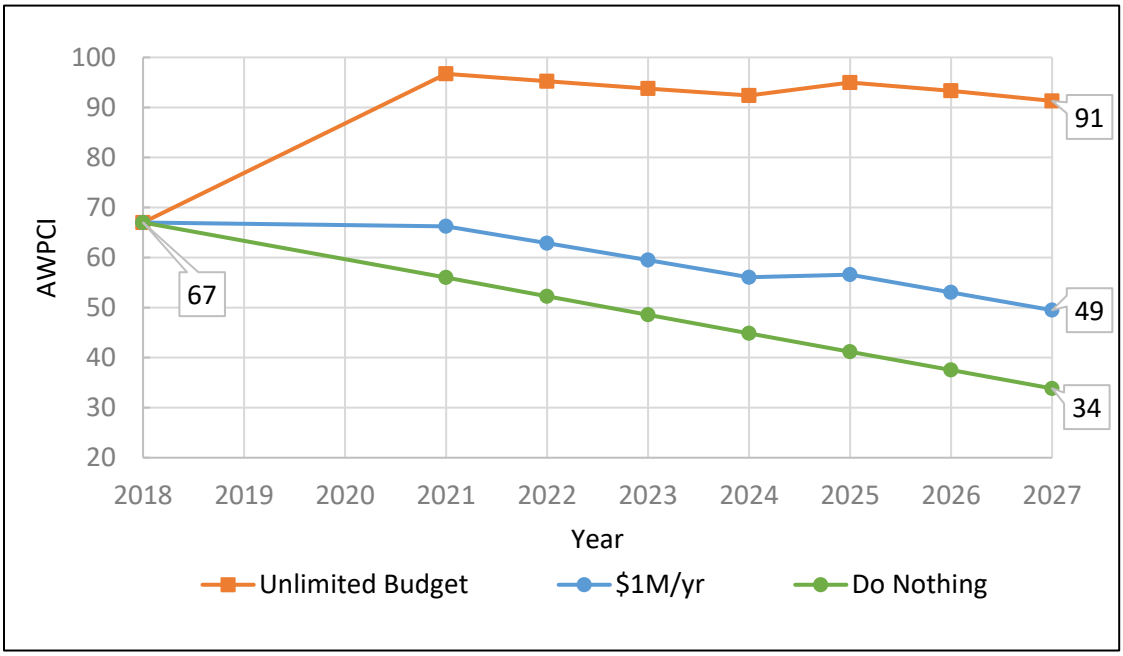


Table 4.2 summarizes the annual funding required for the above analyses. For the unlimited analysis, all pavement needs are funded in the year they are required. Therefore, the unfunded costs are zero. The total funded amount over the 7-year period is approximately $2.1 million. For the annual funding 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 $2.9 million.

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

Year	Unlimited	Maintain PCI[1]	Constrained $1M/year	Do Nothing
2021	$1,831,000	-	$488,000	$0
2022	$2,000	-	$11,000	$0
2023	$3,000	-	$13,000	$0
2024	$5,000	-	$21,000	$0
2025	$221,000	-	$260,000	$0
2026	$3,000	-	$65,000	$0
2027	$5,000	-	$75,000	$0
Total	**$2,070,000**	-	**$932,000**	**$0**
2027 Backlog	**-**	**-**	**$2,933,000**	**$4,274,000**

[1] PAVER could not iterate for this condition

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. 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 $2.5 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 5M0.

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
2024	5M0_24-01_Runway 18-36 Rehabilitation	$1,784,785	296,784	64	100
2025	5M0_25-01_Apron Rehabilitation	$681,794	101,580	59	100
	Total	**$2,466,580**			

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

Branch	Section	Area, sf	PCI Before Rehab	Activity	Activity Type	Cost
5M0_21-01_Runway 18-36 Rehabilitation						**$1,784,785**
R1836	01	269,925	52	Mill 2" & 2" AC OLP	Rehabilitation	$1,573,741
TC01	01	6,760	44	AC Reconstruction	Reconstruction	$69,224
TC02	01	9,027	59	Mill 2" & 2" AC OLP	Rehabilitation	$52,630
TTRW18	01	5,485	49	Mill 2" & 2" AC OLP	Rehabilitation	$31,979
TTRW36	01	5,587	45	AC Reconstruction	Reconstruction	$57,212
5M0_25-01_Apron Rehabilitation						**$681,794**
A01	01	46,877	63	Mill 2" & 2" AC OLP	Rehabilitation	$281,506
A01	02	36,746	51	Mill 2" & 2" AC OLP	Rehabilitation	$220,667
THANG01	01	10,481	48	Mill 2" & 2" AC OLP	Rehabilitation	$62,940
THANG01	02	7,476	46	Mill 2" & 2" AC OLP	Rehabilitation	$44,895
THANG02	01	11,954	46	Mill 2" & 2" AC OLP	Rehabilitation	$71,786
					Total	**$2,466,580**

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 $2.5 million for 5M0:

- FAA (90%): $2.23 million
- ALDOT (5%): $0.12 million
- Airport Sponsor (5%): $0.12 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 $12,534. 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 5M0 pavements.

Table 4.5: Summary of Year-1 Maintenance Plan.

Policy	Work Description	Work Quantity	Work Unit	Work Cost
Preventive	Crack Sealing - AC	1,237	Ft	$4,888
	Patching - AC Full-Depth	305	SqFt	$7,647
			Total	**$12,534**

APPENDIX A

INVENTORY

Appendix A

Pavement Inventory Report

Hartselle-Morgan County Regional Airport (5M0)

Branch ID	Name	Branch Use	Section ID	Rank[1]	Length (ft)	Width (ft)	Area (sf)	LCD[2]	Surface[3]
A01	Apron 1 Hartselle	APRON	01	S	300	135	46,877	5/29/2008	AC
A01	Apron 1 Hartselle	APRON	02	S	215	135	36,746	10/26/1999	AC
R1836	Runway 18-36 Hartselle	RUNWAY	01	P	3,599	75	269,925	12/19/2001	AC
TC01	Taxiway Connector 01 Hartselle	TAXIWAY	01	S	135	37	6,760	10/12/1999	AC
TC02	Taxiway Connector 02 Hartselle	TAXIWAY	01	S	161	33	9,027	10/17/2003	AC
THANG01	Taxiway Hangar 01 Hartselle	TAXIWAY	02	T	170	33	7,476	11/4/2001	AC
THANG01	Taxiway Hangar 01 Hartselle	TAXIWAY	01	T	170	60	10,481	7/3/2002	AC
THANG02	Taxiway Hangar 02 Hartselle	TAXIWAY	02	T	166	84	17,279	11/2/2013	AC
THANG02	Taxiway Hangar 02 Hartselle	TAXIWAY	01	T	178	67	11,954	10/7/2004	AC
TTRW18	Taxiway Turnaround RW18 Hartselle	TAXIWAY	01	P	100	50	5,485	11/4/2001	AC
TTRW36	Taxiway Turnaround RW36 Hartselle	TAXIWAY	01	P	100	50	5,587	8/14/2000	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 = Aphalt Overlay AC, PCC = Portland cement Concrete, APC = Asphalt Overlay PCC

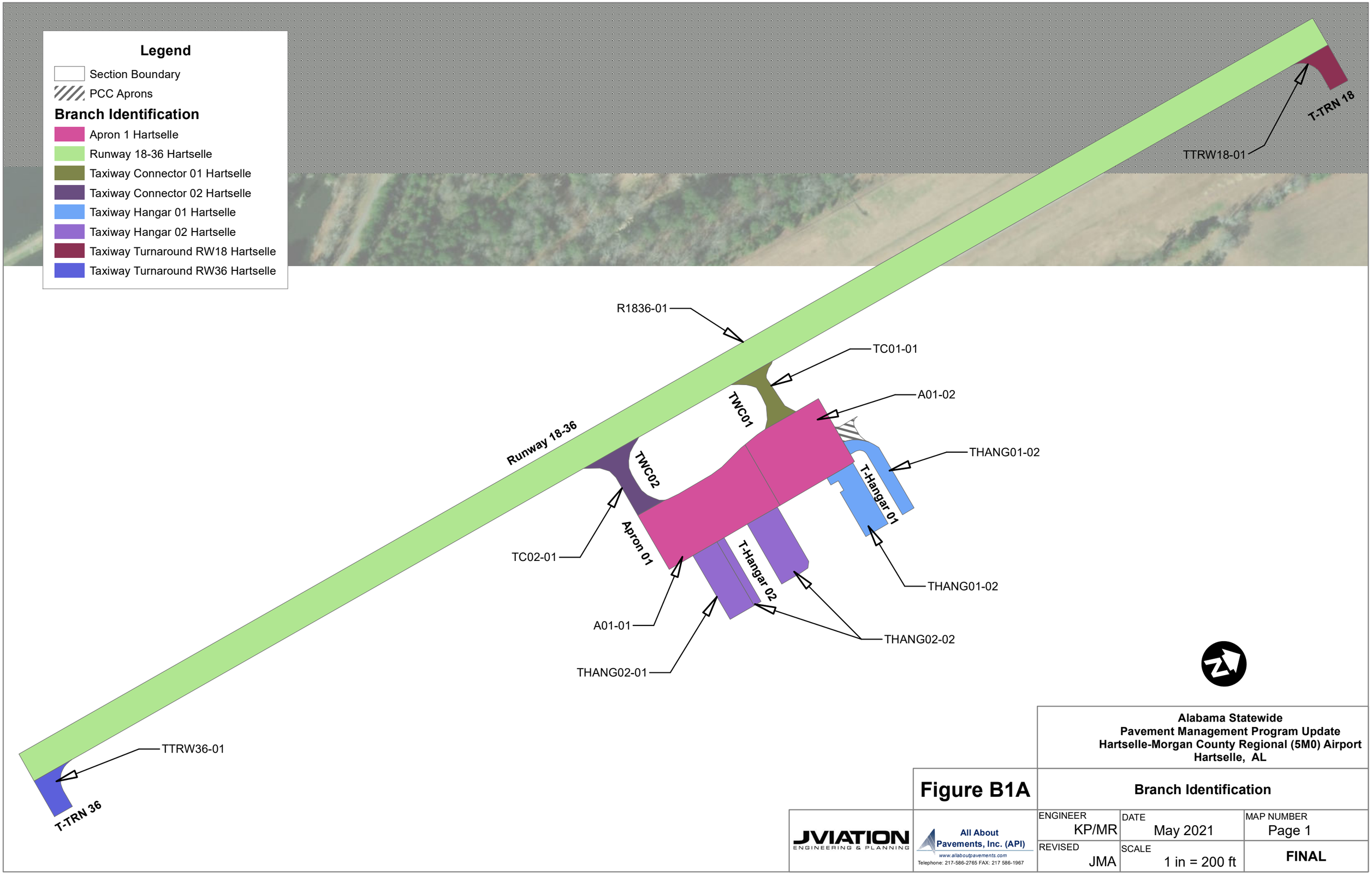
APPENDIX B

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



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Hartselle-Morgan County Regional (5M0) Airport
Hartselle, AL

Figure B1A

Branch Identification

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ENGINEER	DATE	MAP NUMBER
KP/MR	May 2021	Page 1
REVISED	SCALE	
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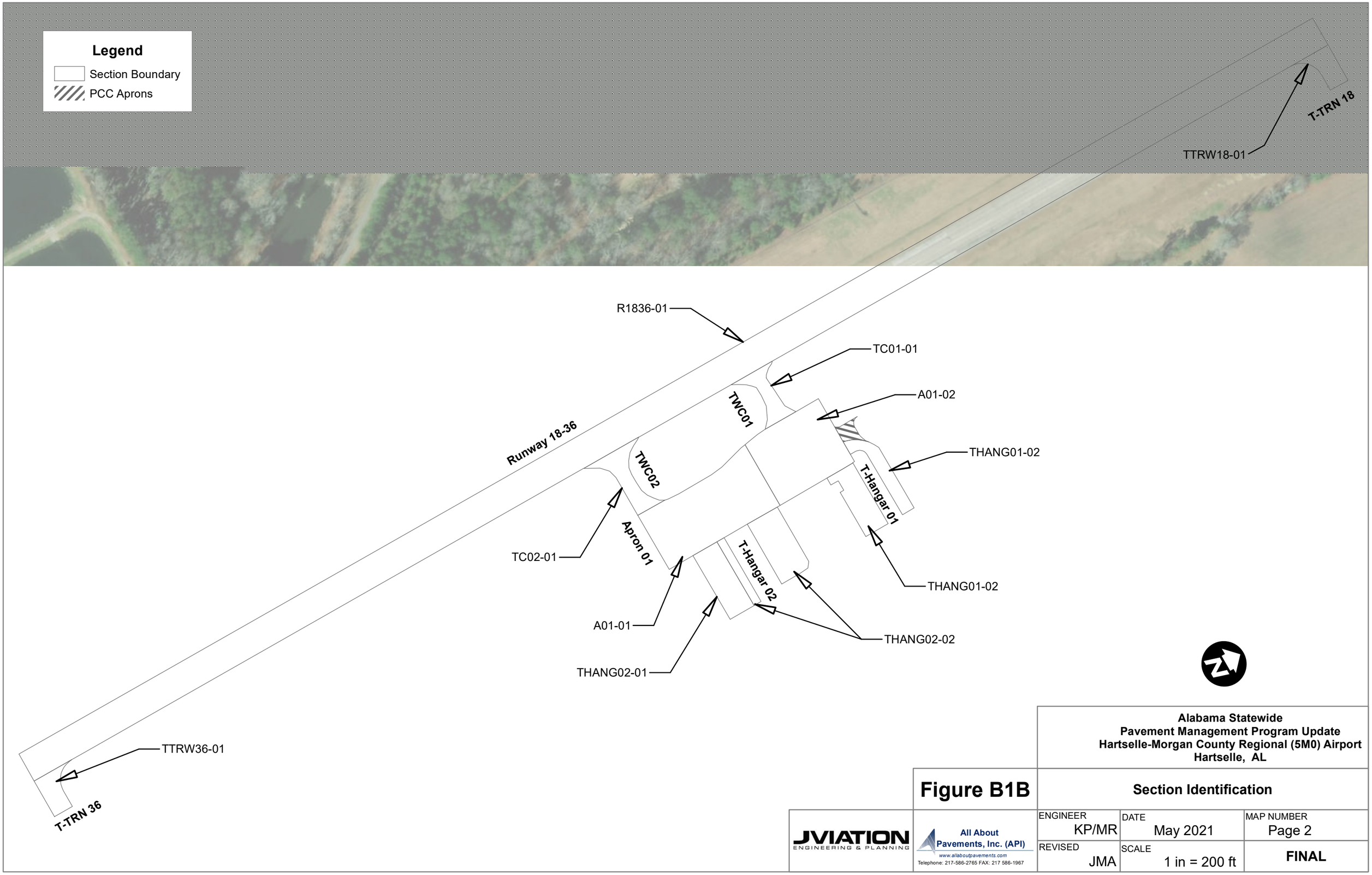

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Figure B1B

Section Identification

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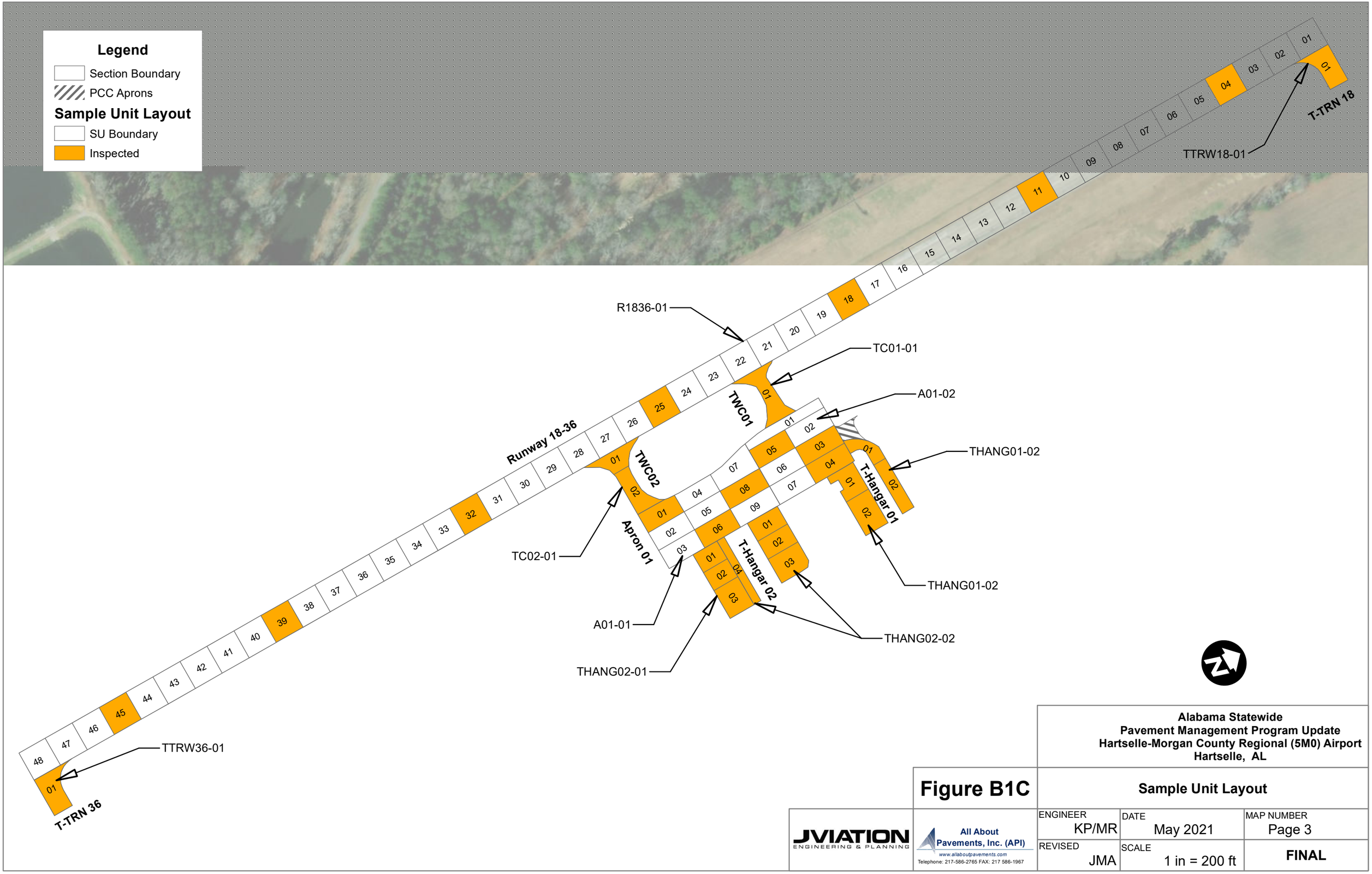

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Figure B1C

Sample Unit Layout

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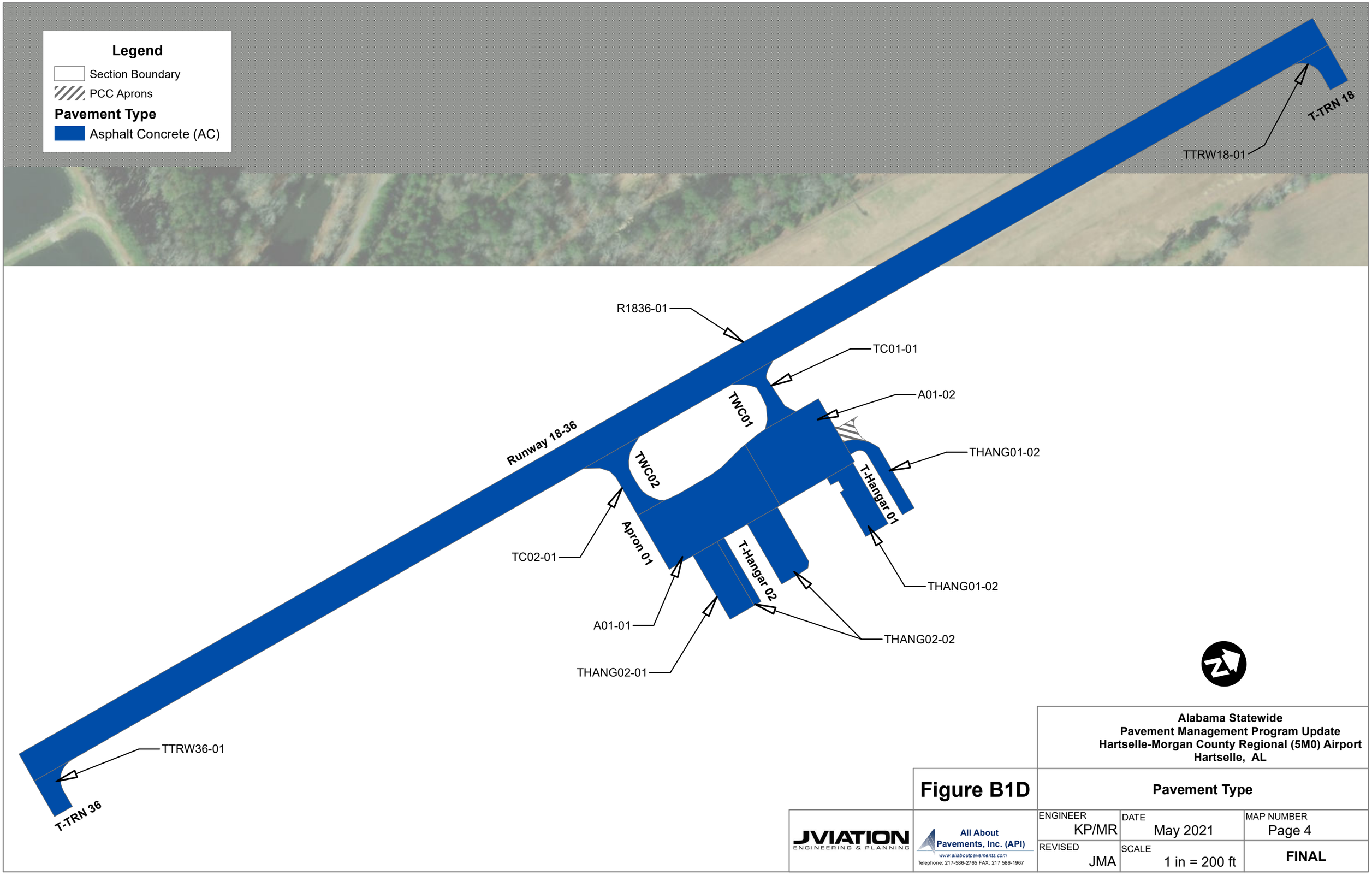

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Figure B1D

Pavement Type

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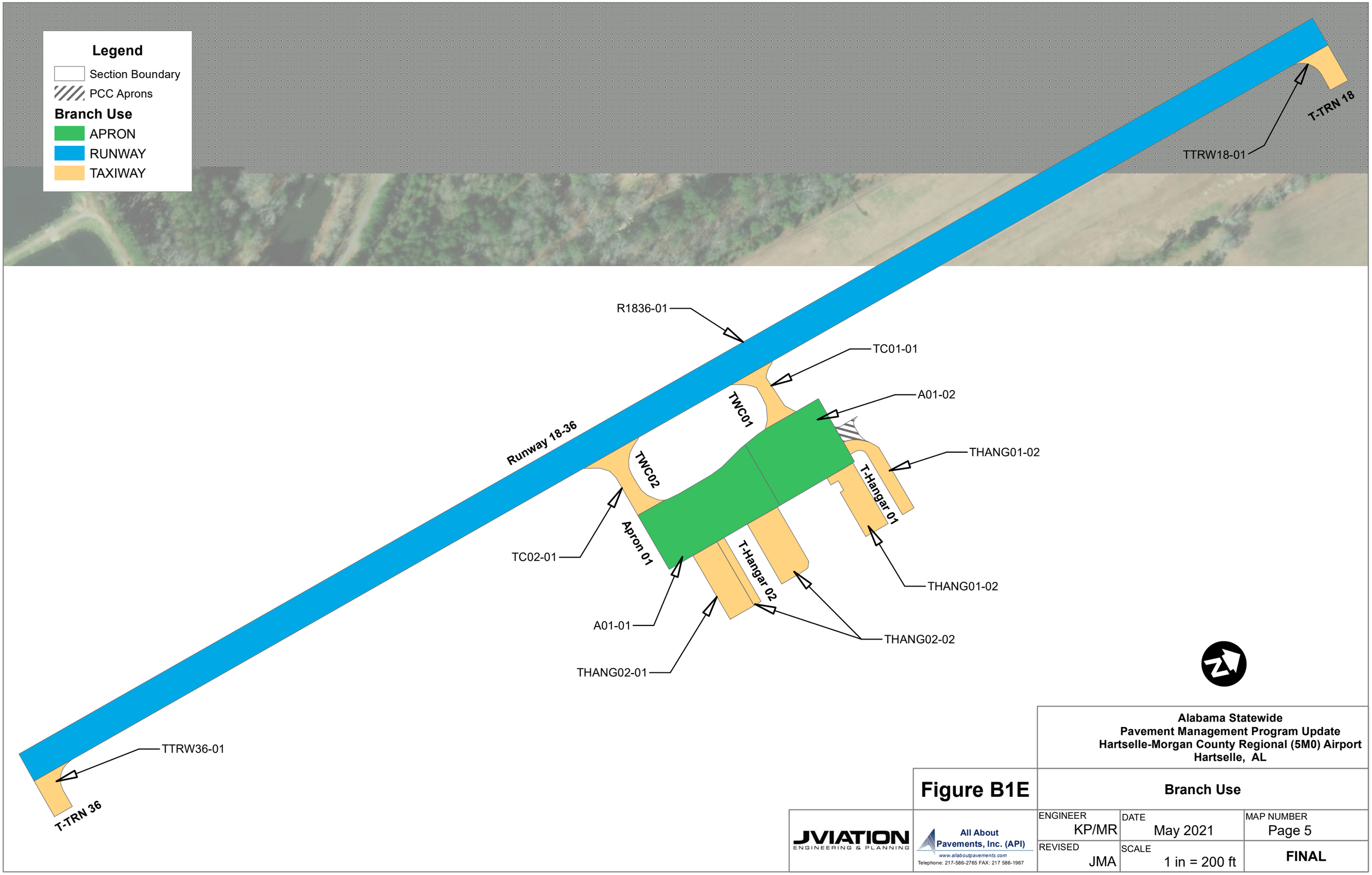

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Figure B1E

Branch Use

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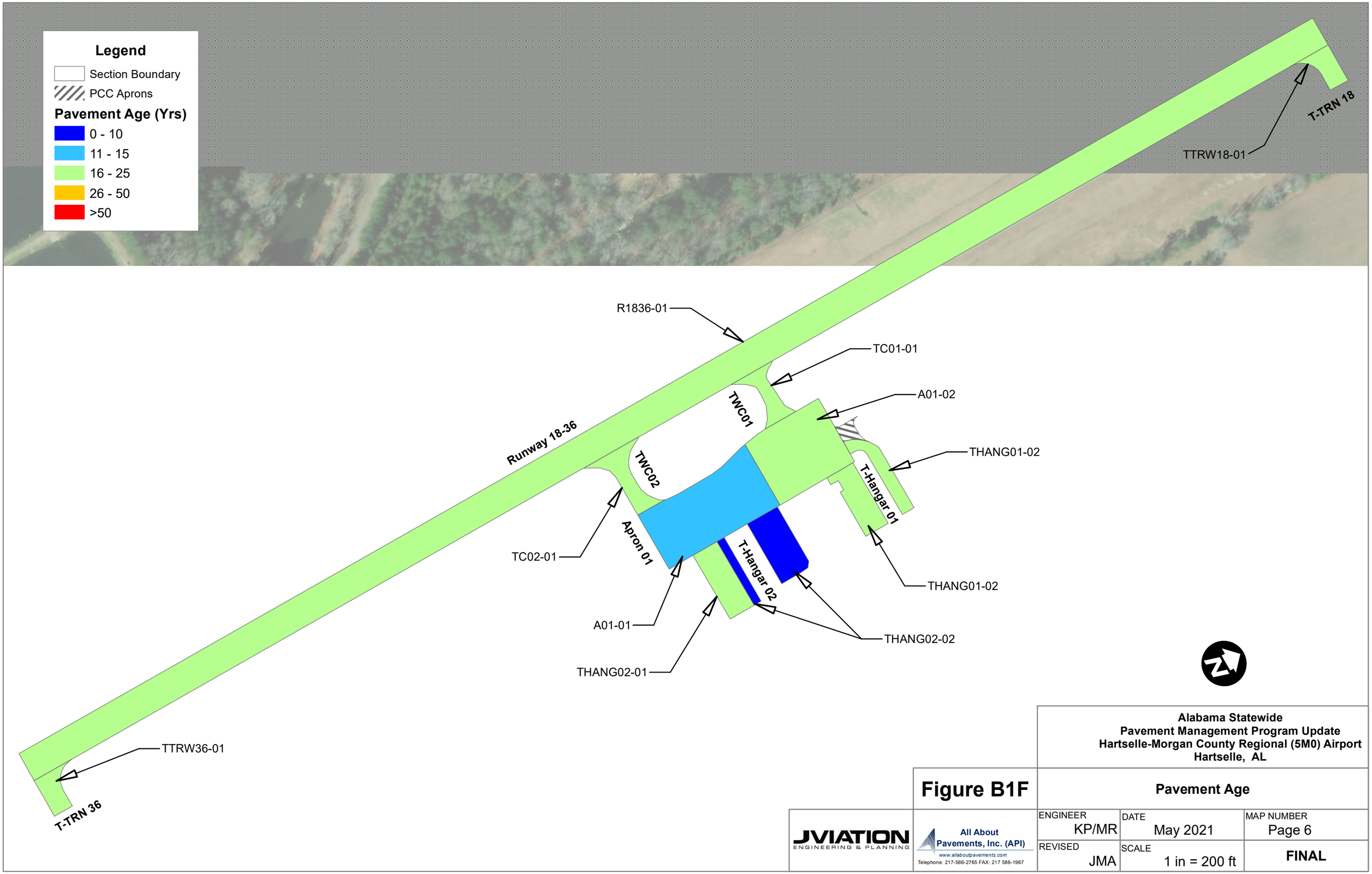

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Figure B1F

Pavement Age

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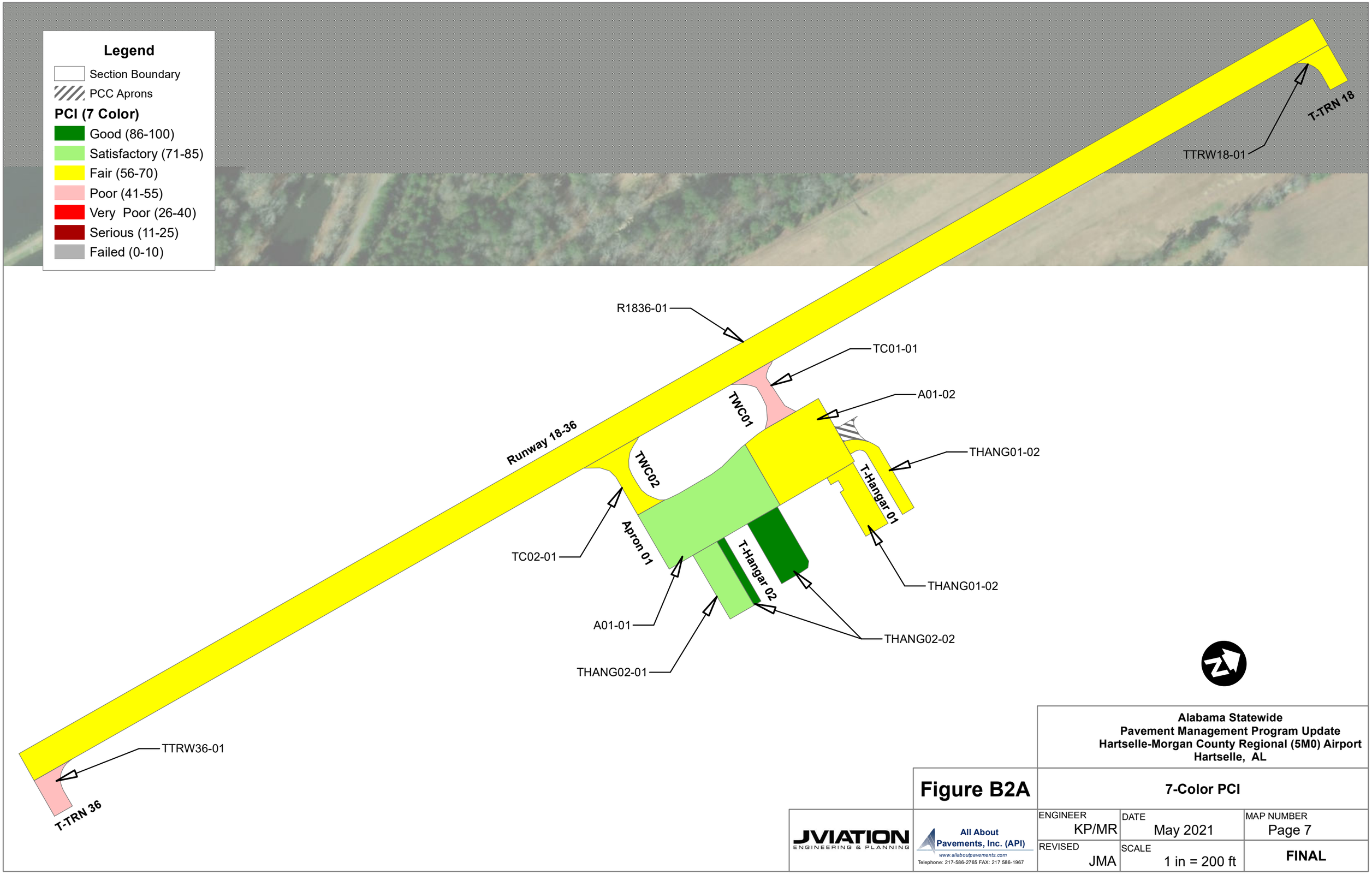

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Figure B2A

7-Color PCI

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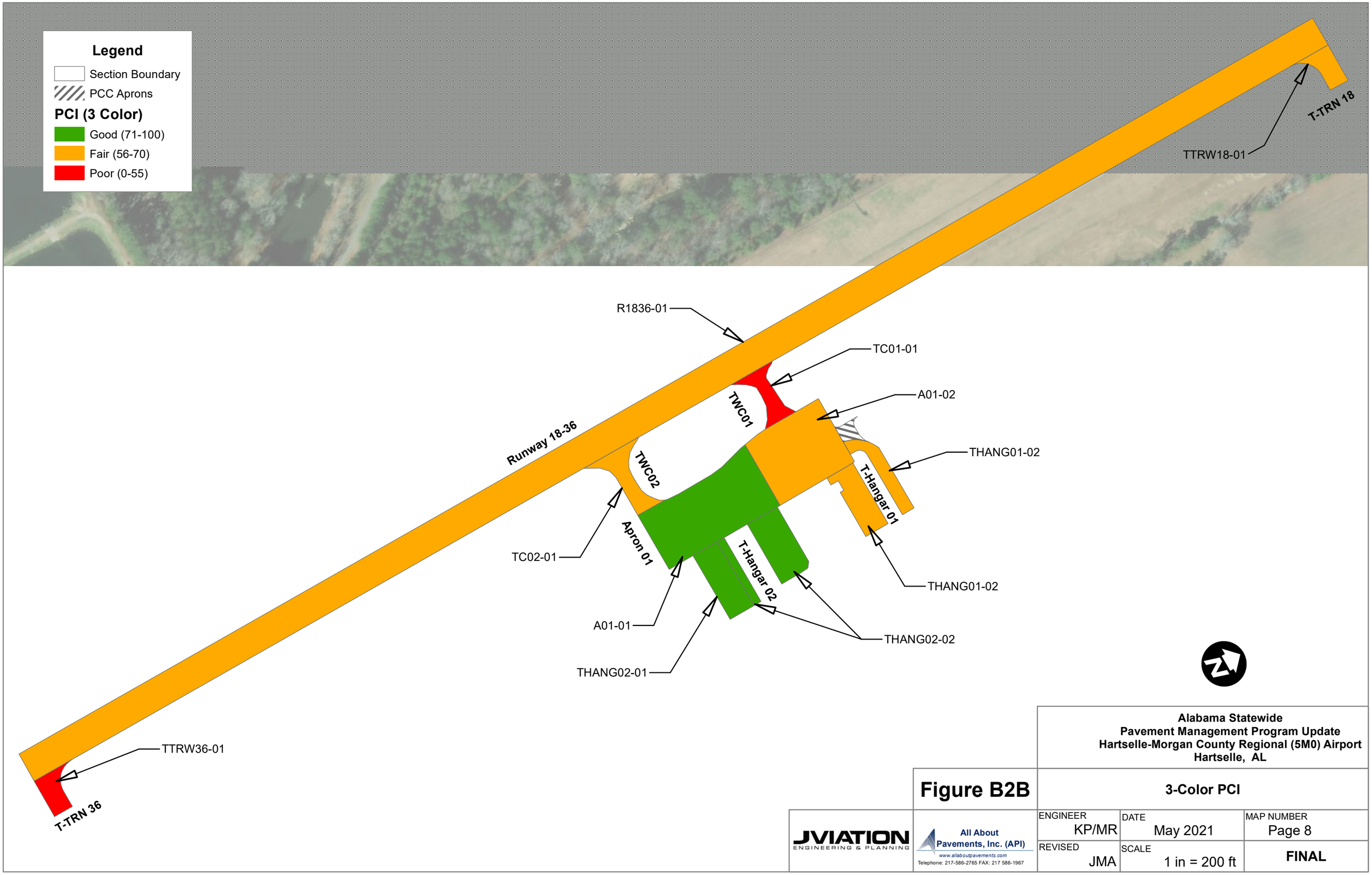

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Figure B2B

3-Color PCI

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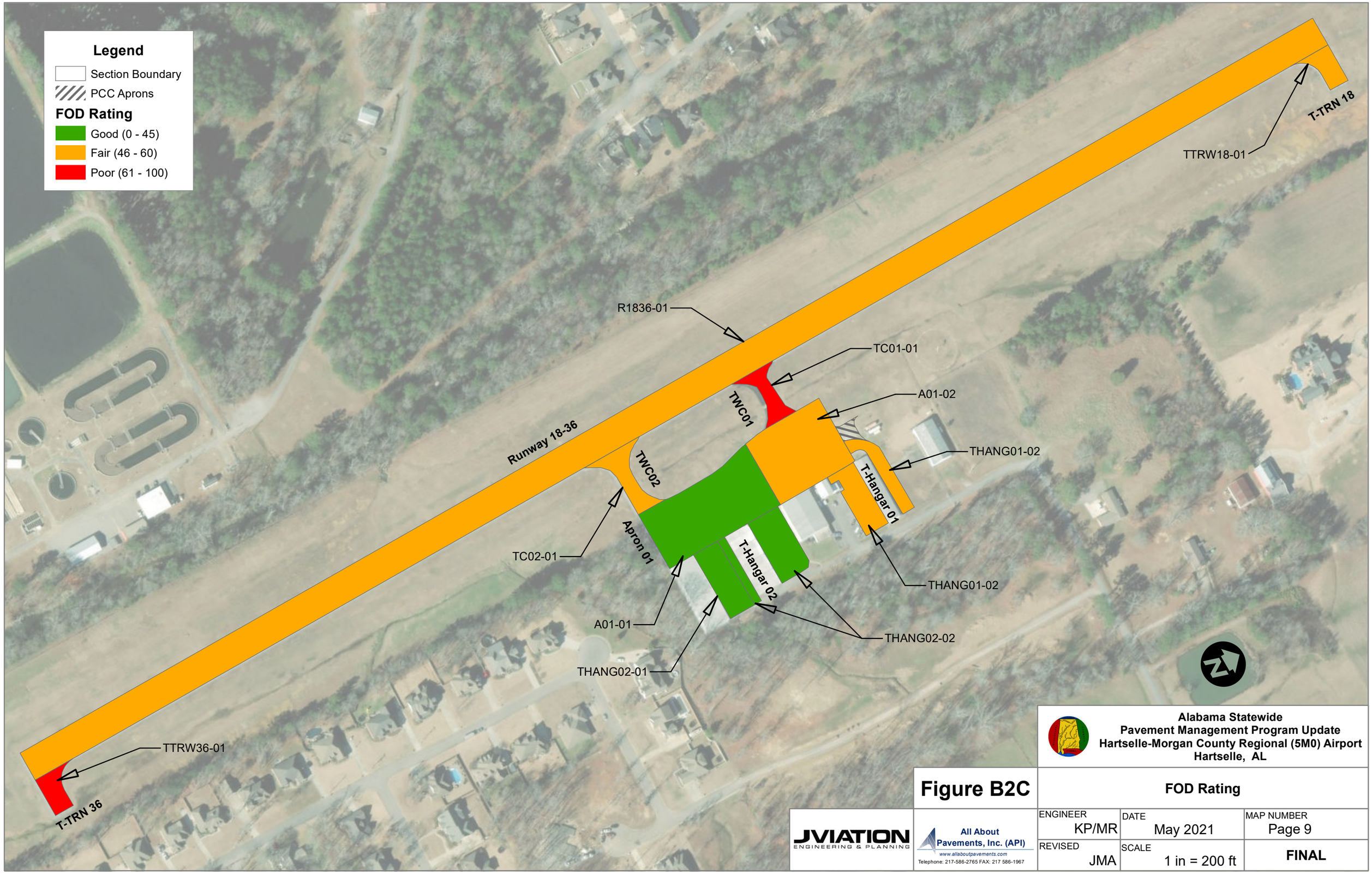

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Figure B2C

FOD Rating

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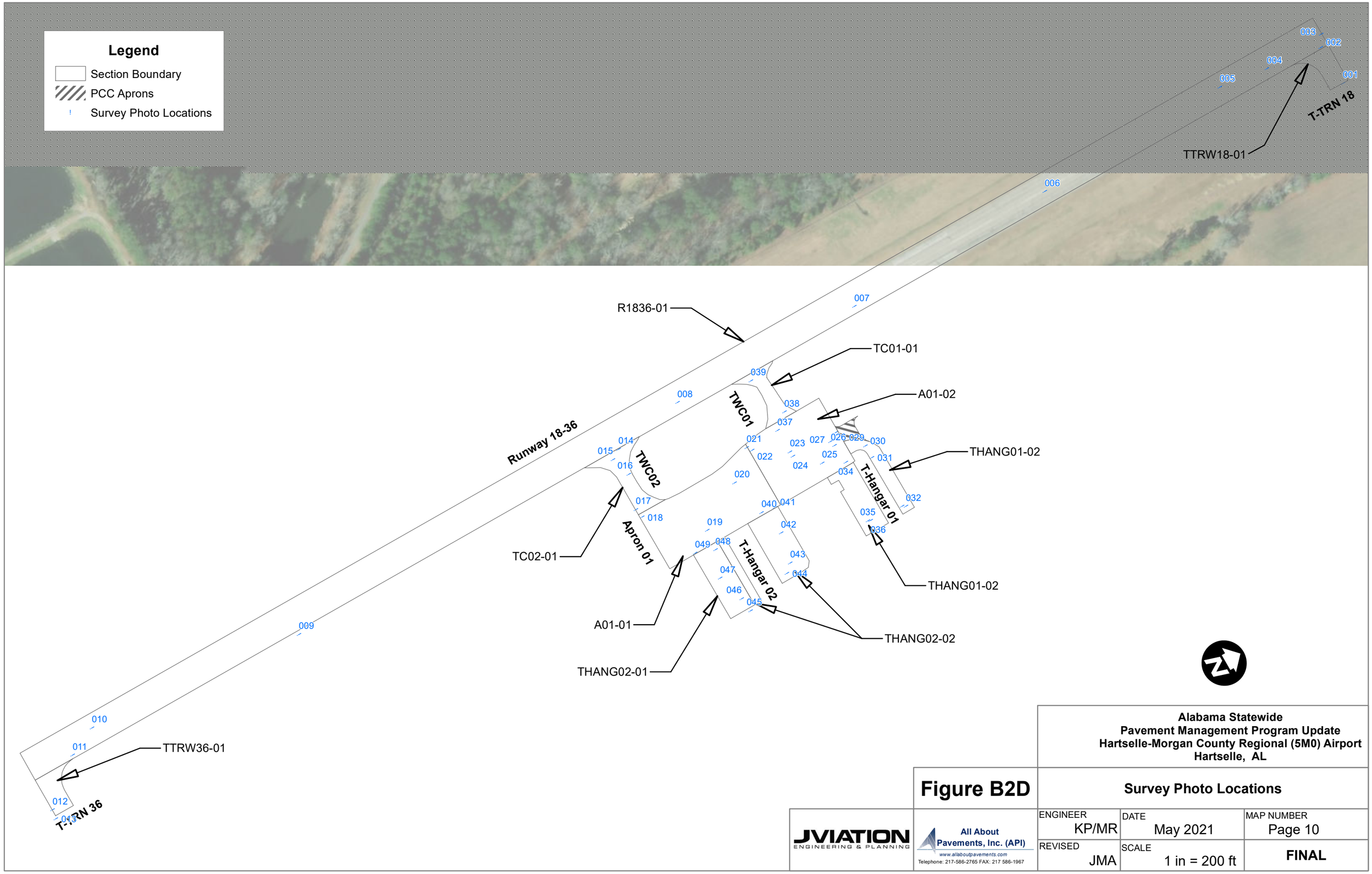

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Figure B2D

Survey Photo Locations

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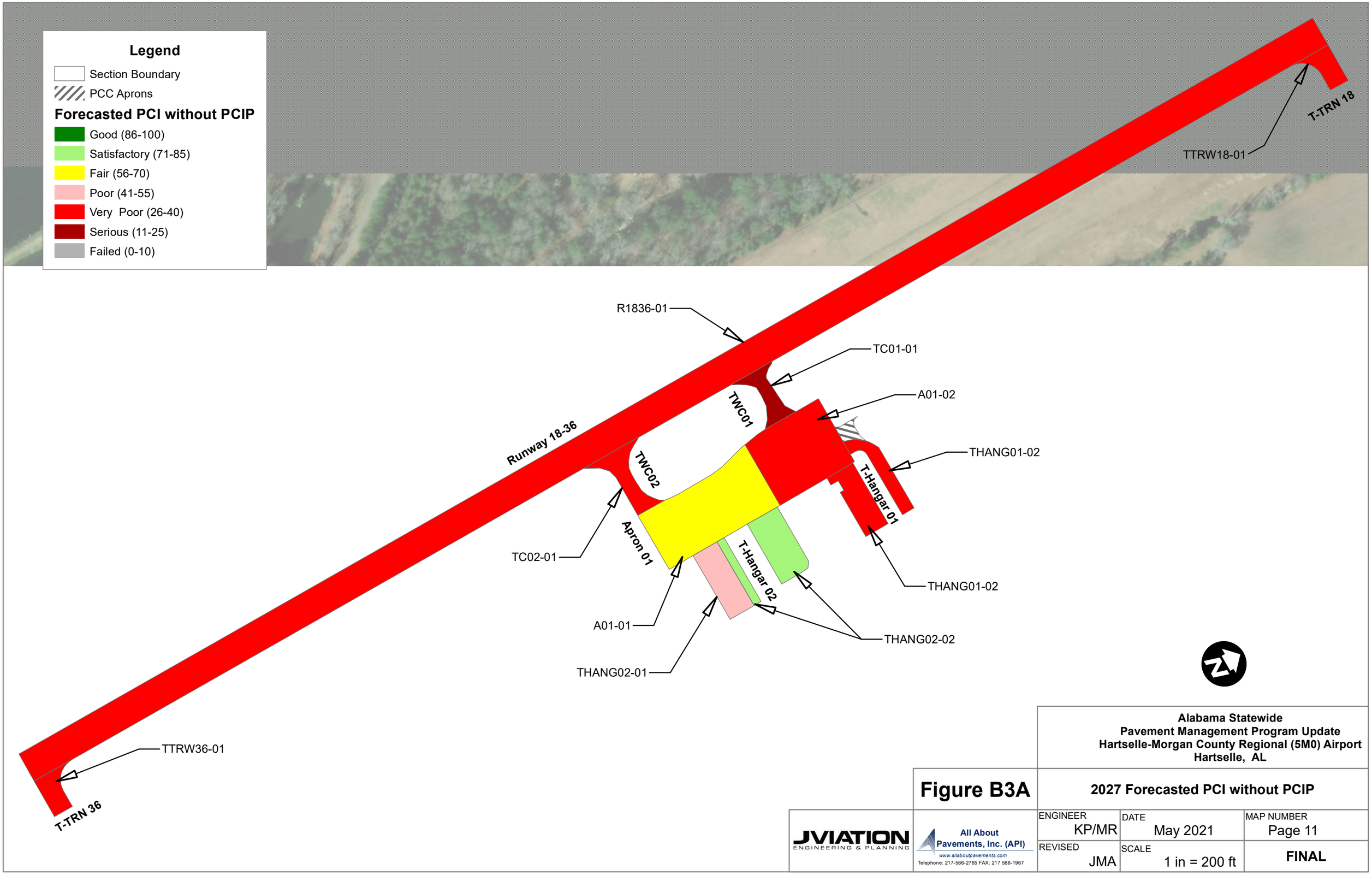

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Figure B3A

2027 Forecasted PCI without PCIP

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ENGINEER	DATE	MAP NUMBER
KP/MR	May 2021	Page 11
REVISED	SCALE	
JMA	1 in = 200 ft	**FINAL**

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

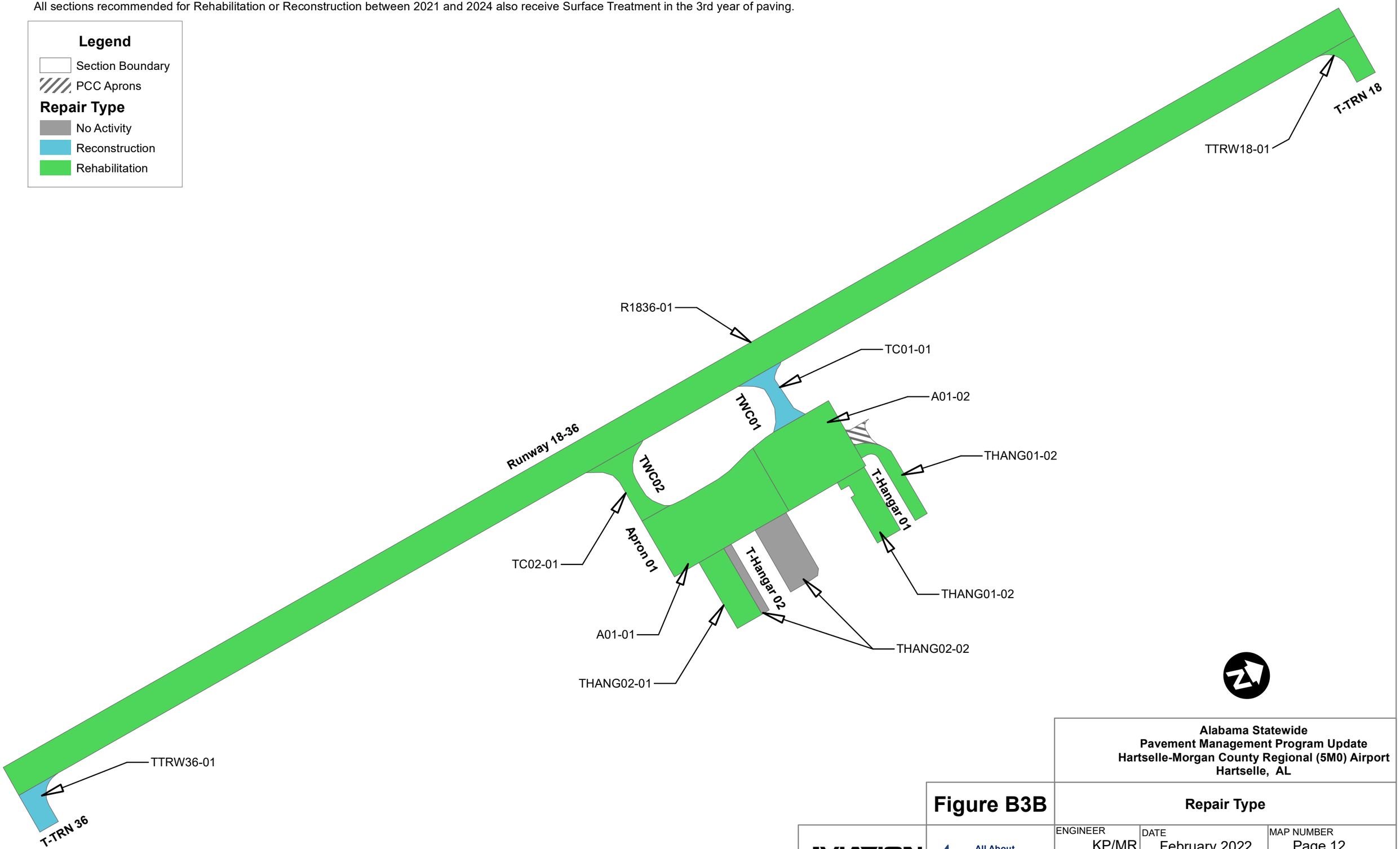

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Figure B3B

Repair Type

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ENGINEER	DATE	MAP NUMBER
KP/MR	February 2022	Page 12
REVISED	SCALE	
JMA	1 in = 200 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

- 5M0_24-01_Runway 18-36 Rehabilitation
- 5M0_25-01_Apron Rehabilitation

M&R Activity

- AC Reconstruction
- Mill 2" & 2" AC OLP
- No Activity

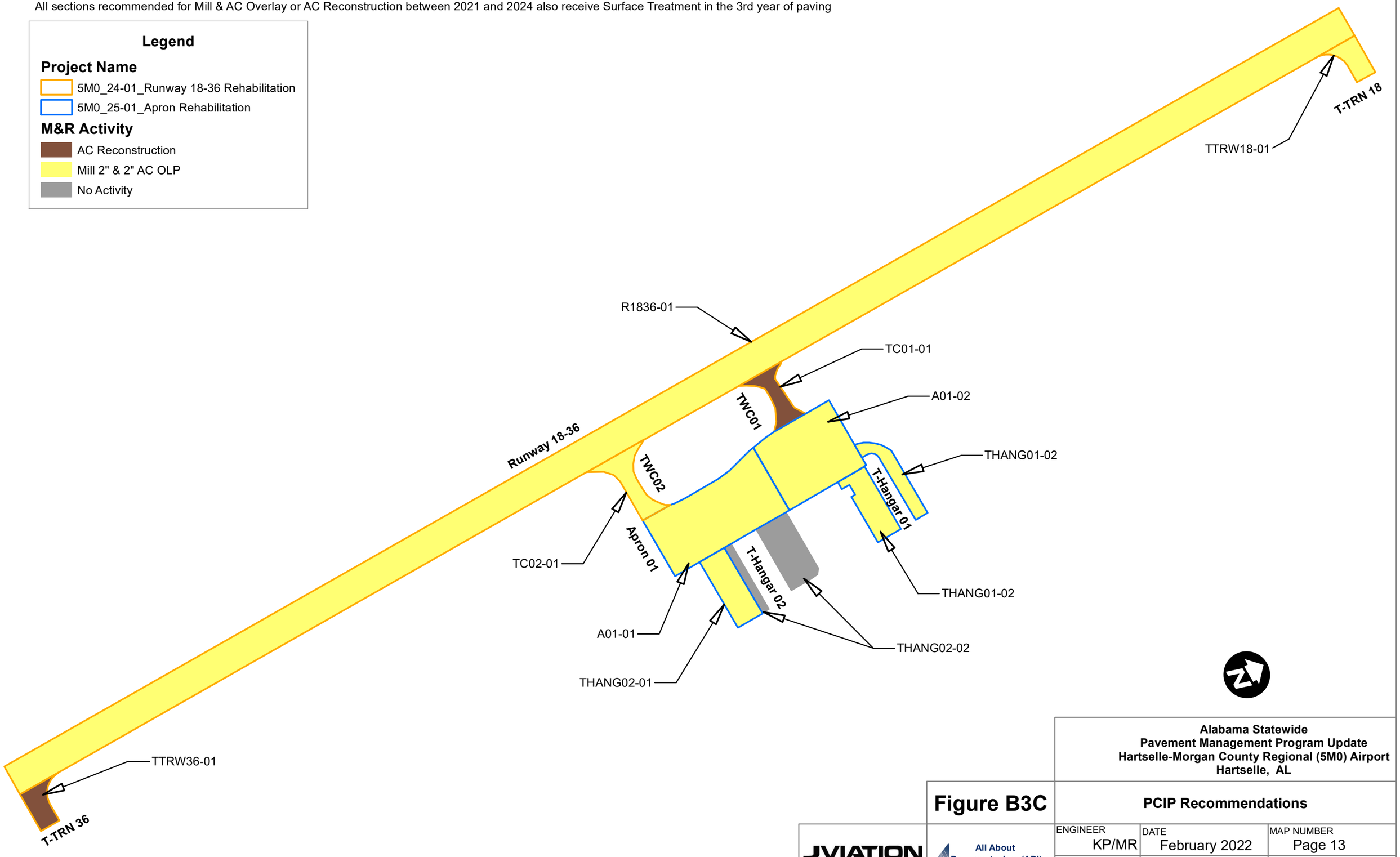

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Figure B3C

PCIP Recommendations

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KP/MR	February 2022	Page 13
REVISED	SCALE	
JMA	1 in = 200 ft	FINAL

APPENDIX C

OVERVIEW OF PAVEMENT DISTRESSES

1. Alligator Cracking (AC)

2. Bleeding (AC)

3. Block Cracking (AC)

-
-
-

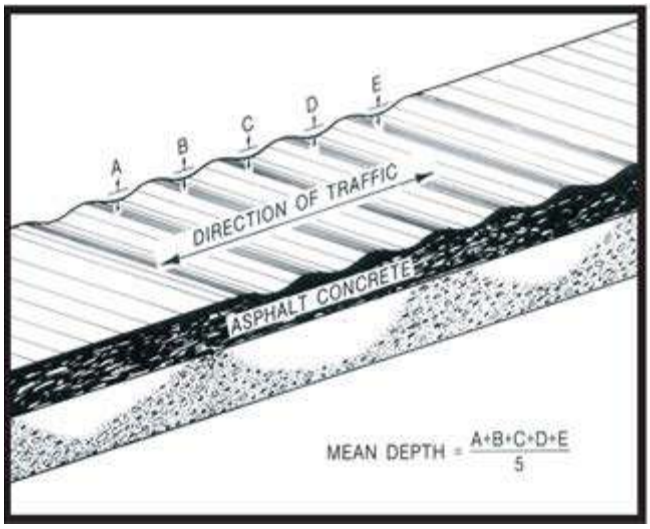
-
-
-

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



_____

-
-
-

_____

-
-
-


CAP

7. Joint Reflection Cracking (AC)

_____

-
-

-

_____

-
-
-


48 M

9. Oil Spillage (AC)

_____

_____

-
-

10. Patching

_____

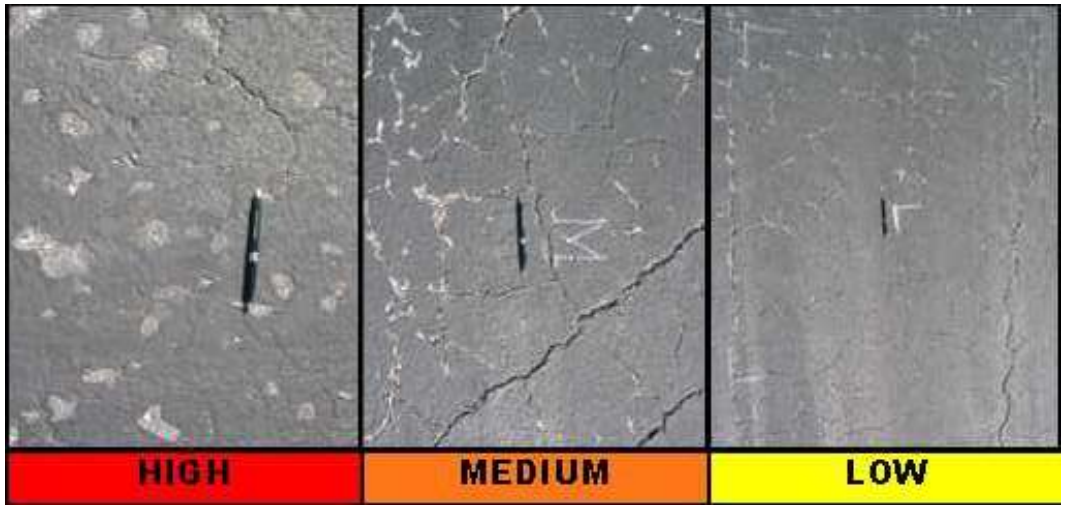
-
-
-

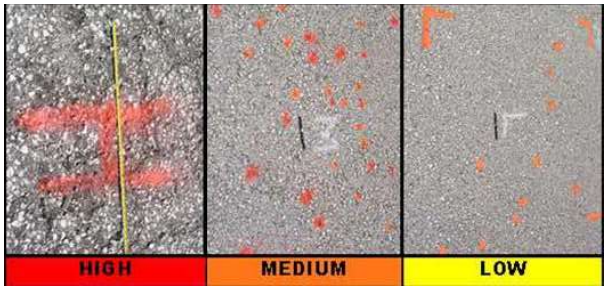
_____

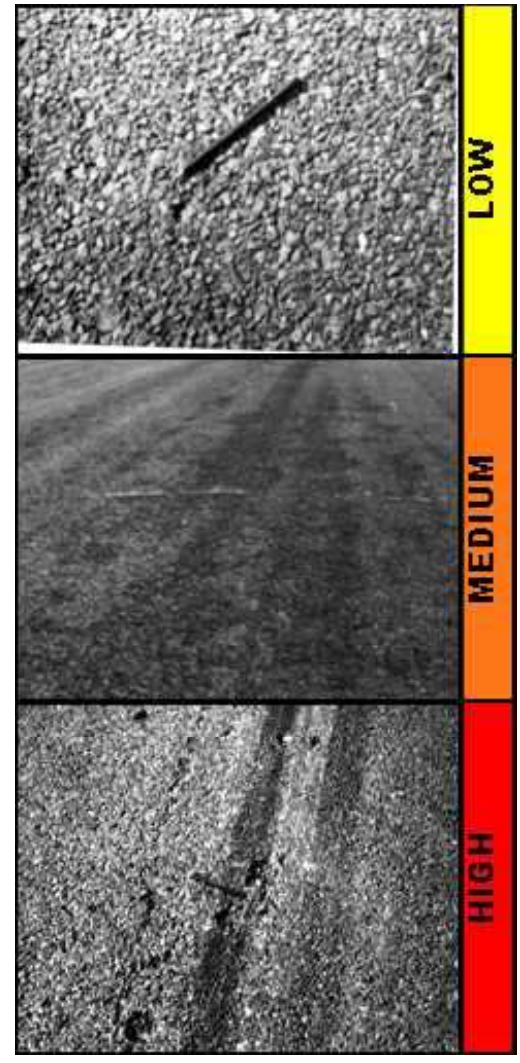
-
-
-

11. Polished Aggregate (AC)

12. Raveling (AC)


HIGH
MEDIUM
LOW


HIGH
MEDIUM
LOW


LOW
MEDIUM
HIGH

13. Rutting (AC)

-
-
-

-
-
-

from the direction of traffic. They are produced when braking or turning wheels cause the

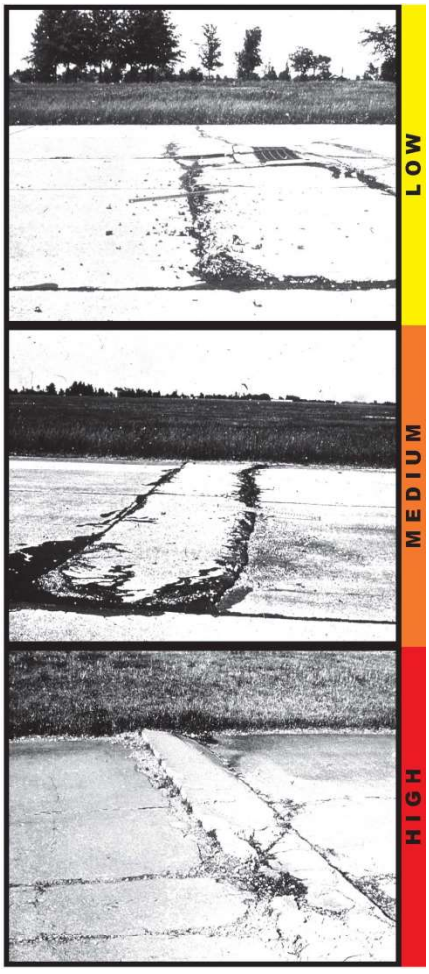
_____ No degrees of severity are defined. It is sufficient to indicate that a slippage

_____

- ♦
- ♦

15. Swelling (AC)

16. Weathering (AC)

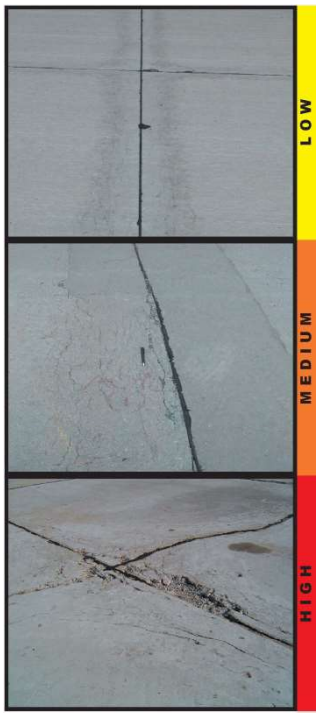

LOW
MEDIUM
HIGH

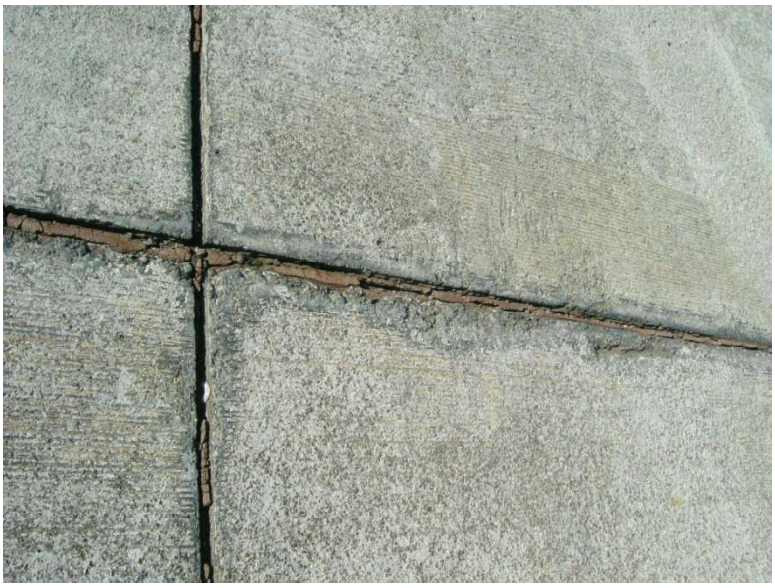
- filled, it has a mean width less than approximately 1 inch (3 millimeters); a filled crack can be of any width, but the filler material

- One of the following conditions exists: (1) filled or non filled c 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

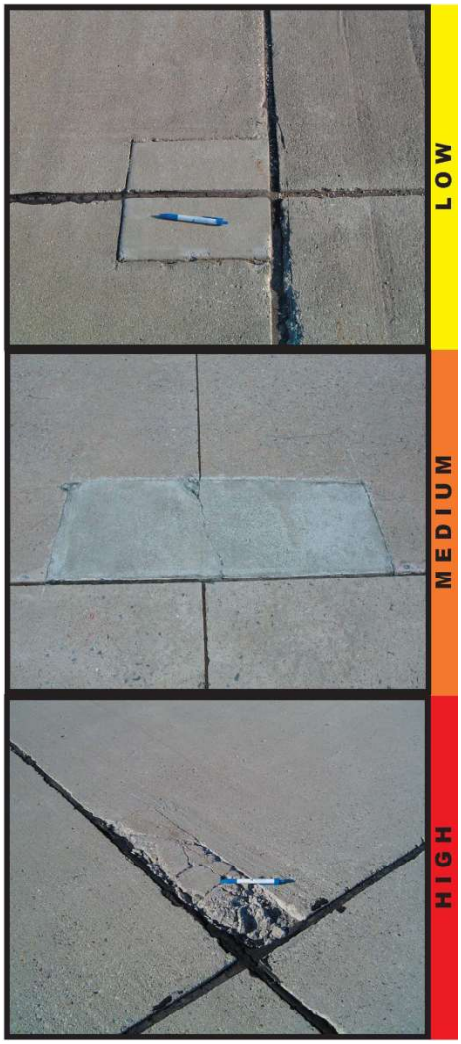
- One of the following conditions exists: (1) filled or non filled crack is severely spalled, causing definite FOD potential; (2) a non filled crack ha

parallel to a joint or linear crack. A dark coloring can usually be seen around the fine





has been removed and replaced by a filler



Patching is the same as defined

No degrees of severity are defined for popouts.

of approximately 1⁄4 to 1⁄2 in

Severity levels are defined by the difference in elevation across the fault and the

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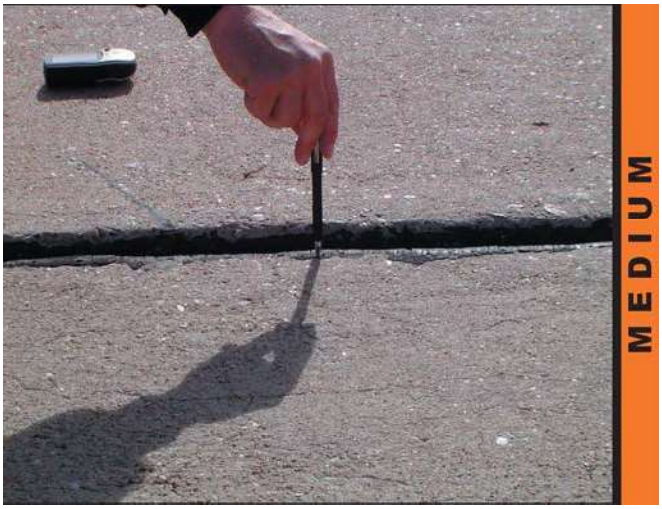

severity level of this distress type, as defined below,

- Slab is broken into four or five pieces with the vast majority of the cracks
- (1) Slab is broken into four or five pieces with over 15 percent of the
- four or five pieces with some or all of the cracks of high severity; (2) slab is

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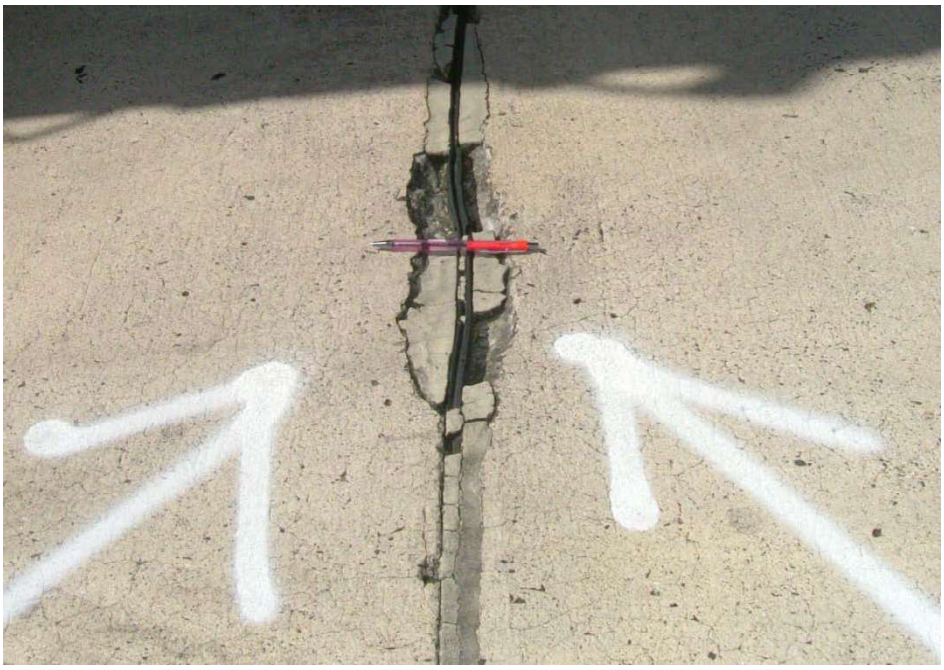
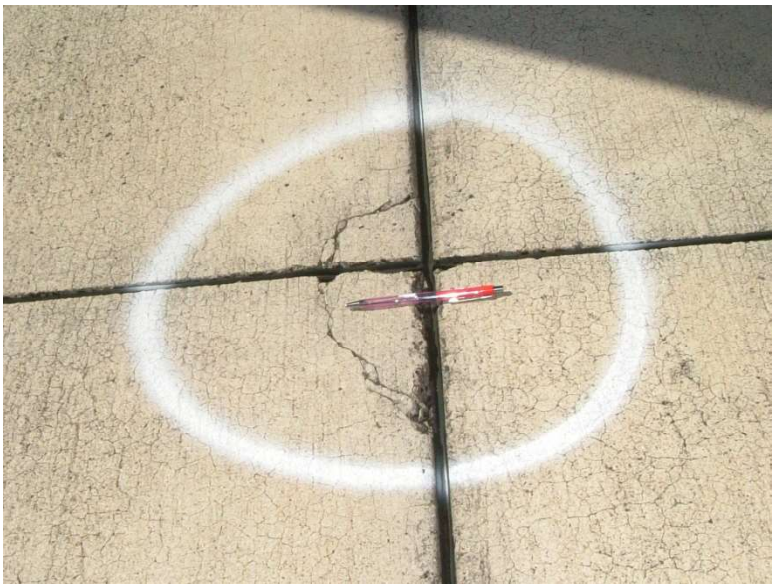
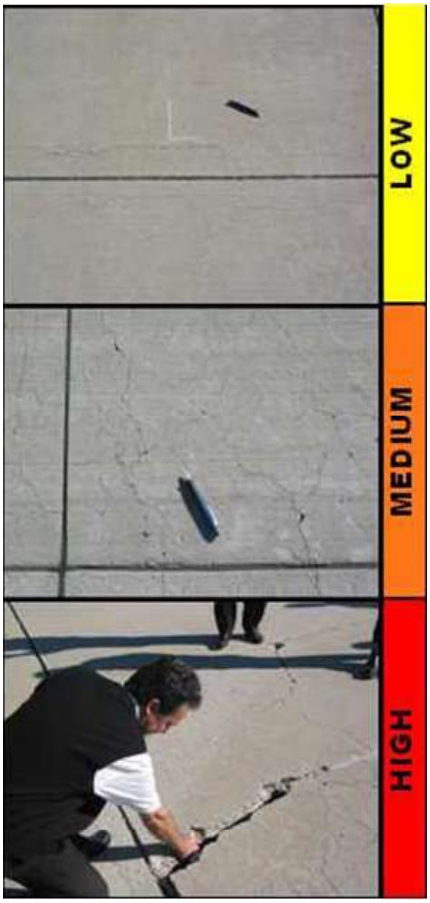
-

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






LOW
MEDIUM
HIGH

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APPENDIX D

DETAILED PAVEMENT CONDITION DATA

APPENDIX E

DISTRESS SUMMARY REPORT

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I l·NŭǎŜŧŧŜπ a 2NƎl·yƳ / 2ǳyŭè wŜƎƛ2yl·ƒ ! ƛNLJ2Nŭ óp a лó

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I ŀŊǘăŜŦŦŜπ a 2ŊƎŀyƳ / 2ǳyǘè wŜƎƛ2yŀƒ !ƛŊĿĴ2Ŋǘ óp a лó

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¢I!bDлм	лн	!/	тĿптс	пр	59tw9{{Ŀhb	hǘKŜŊ	aŜŘƛǳŶ	мр	{ljCǘ	лфп
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APPENDIX F

PAVEMENT CONDITION REPORTS

F1: Section Forecasted Pavement Condition Rating
F2: Branch PCI Rating
F3: Branch FOD Rating

Appendix F1

Forecasted Section PCI

Hartselle-Morgan County Regional Airport (5M0)

Branch ID	Section ID	Forecasted PCI						
		2021	2022	2023	2024	2025	2026	2027
A01	01	72	70	68	66	63	61	59
A01	02	53	51	49	47	44	42	40
R1836	01	52	47	43	39	35	30	26
TC01	01	44	40	37	33	30	26	22
TC02	01	59	54	49	46	44	40	37
THANG01	01	52	48	45	43	39	36	32
THANG01	02	49	46	44	40	37	33	30
THANG02	01	63	59	54	49	46	44	40
THANG02	02	94	92	89	87	84	82	80
TTRW18	01	49	46	44	40	37	33	30
TTRW36	01	45	43	40	36	33	29	25

A01	2	515.00	135.00	83,623.00	APRON	32.50	9.50	31.35
R1836	1	3,599.00	75.00	269,925.00	RUNWAY	34.00	0.00	34.00
TC01	1	135.00	37.00	6,760.00	TAXIWAY	50.00	0.00	50.00
TC02	1	161.00	33.00	9,027.00	TAXIWAY	32.00	0.00	32.00
THANG01	2	340.00	46.50	17,957.00	TAXIWAY	37.00	0.00	37.00
THANG02	2	344.00	75.50	29,233.00	TAXIWAY	15.50	13.50	13.04
TTRW18	1	100.00	50.00	5,485.00	TAXIWAY	40.00	0.00	40.00
TTRW36	1	100.00	50.00	5,587.00	TAXIWAY	46.00	0.00	46.00

APRON	2	83,623.00	32.50	9.50	31.35
RUNWAY	1	269,925.00	34.00	0.00	34.00
TAXIWAY	8	74,049.00	34.13	13.72	29.02
ALL	11	427,597.00	33.82	12.40	32.62

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

Appendix G2
Localized Preventive Repair Policy

Distress	Distress Severity	Description	Code	Work Type	Work Unit
41	Medium	ALLIGATOR CR	PA-AD	Patching - AC Full-Depth	SqFt
41	High	ALLIGATOR CR	PA-AD	Patching - AC Full-Depth	SqFt
42	N/A	BLEEDING	PA-AS	Patching - AC Partial-Depth	SqFt
43	High	BLOCK CR	PA-AD	Patching - AC Full-Depth	SqFt
43	Medium	BLOCK CR	CS-AC	Crack Sealing - AC	Ft
44	Low	CORRUGATION	PA-AS	Patching - AC Partial-Depth	SqFt
44	High	CORRUGATION	PA-AS	Patching - AC Partial-Depth	SqFt
44	Medium	CORRUGATION	PA-AS	Patching - AC Partial-Depth	SqFt
45	Medium	DEPRESSION	PA-AD	Patching - AC Full-Depth	SqFt
45	Low	DEPRESSION	PA-AD	Patching - AC Full-Depth	SqFt
45	High	DEPRESSION	PA-AD	Patching - AC Full-Depth	SqFt
47	High	JT REF. CR	CS-AC	Crack Sealing - AC	Ft
47	Medium	JT REF. CR	CS-AC	Crack Sealing - AC	Ft
48	High	L & T CR	CS-AC	Crack Sealing - AC	Ft
48	Medium	L & T CR	CS-AC	Crack Sealing - AC	Ft
49	N/A	OIL SPILLAGE	PA-AD	Patching - AC Full-Depth	SqFt
50	High	PATCHING	PA-AD	Patching - AC Full-Depth	SqFt
50	Medium	PATCHING	PA-AD	Patching - AC Full-Depth	SqFt
52	High	RAVELING	PA-AS	Patching - AC Partial-Depth	SqFt
53	High	RUTTING	PA-AD	Patching - AC Full-Depth	SqFt
53	Low	RUTTING	PA-AD	Patching - AC Full-Depth	SqFt
53	Medium	RUTTING	PA-AD	Patching - AC Full-Depth	SqFt
55	N/A	SLIPPAGE CR	PA-AD	Patching - AC Full-Depth	SqFt
56	Low	SWELLING	PA-AD	Patching - AC Full-Depth	SqFt
56	Medium	SWELLING	PA-AD	Patching - AC Full-Depth	SqFt
61	Low	BLOW-UP	PA-PF	Patching - PCC Full Depth	SqFt
61	Medium	BLOW-UP	PA-PF	Patching - PCC Full Depth	SqFt
61	High	BLOW-UP	PA-PF	Patching - PCC Full Depth	SqFt
62	Medium	CORNER BREAK	PA-PF	Patching - PCC Full Depth	SqFt
62	High	CORNER BREAK	PA-PF	Patching - PCC Full Depth	SqFt
62	Low	CORNER BREAK	CS-PC	Crack Sealing - PCC	Ft
63	Medium	LINEAR CR	CS-PC	Crack Sealing - PCC	Ft
63	High	LINEAR CR	PA-PP	Patching - PCC Partial Depth	SqFt
64	Medium	DURABIL. CR	PA-PF	Patching - PCC Full Depth	SqFt
64	High	DURABIL. CR	SL-PC	Slab Replacement - PCC	SqFt
65	High	JT SEAL DMG	JS-LC	Joint Seal (Localized)	Ft
65	Medium	JT SEAL DMG	JS-LC	Joint Seal (Localized)	Ft
66	High	SMALL PATCH	PA-PP	Patching - PCC Partial Depth	SqFt
66	Medium	SMALL PATCH	PA-PP	Patching - PCC Partial Depth	SqFt
67	Medium	LARGE PATCH	PA-PF	Patching - PCC Full Depth	SqFt

Appendix G2
Localized Preventive Repair Policy

Distress	Distress Severity	Description	Code	Work Type	Work Unit
67	High	LARGE PATCH	PA-PF	Patching - PCC Full Depth	SqFt
69	N/A	PUMPING	JS-LC	Joint Seal (Localized)	Ft
70	Medium	SCALING	PA-PP	Patching - PCC Partial Depth	SqFt
70	High	SCALING	SL-PC	Slab Replacement - PCC	SqFt
71	High	FAULTING	GR-PP	Grinding (Localized)	Ft
71	Medium	FAULTING	GR-PP	Grinding (Localized)	Ft
72	Medium	SHAT. SLAB	SL-PC	Slab Replacement - PCC	SqFt
72	High	SHAT. SLAB	SL-PC	Slab Replacement - PCC	SqFt
74	High	JOINT SPALL	PA-PP	Patching - PCC Partial Depth	SqFt
74	Medium	JOINT SPALL	PA-PP	Patching - PCC Partial Depth	SqFt
75	Medium	CORNER SPALL	PA-PP	Patching - PCC Partial Depth	SqFt
75	High	CORNER SPALL	PA-PP	Patching - PCC Partial Depth	SqFt
76	Medium	ASR	SL-PC	Slab Replacement - PCC	SqFt
76	High	ASR	SL-PC	Slab Replacement - PCC	SqFt

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 RSMeans, 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.

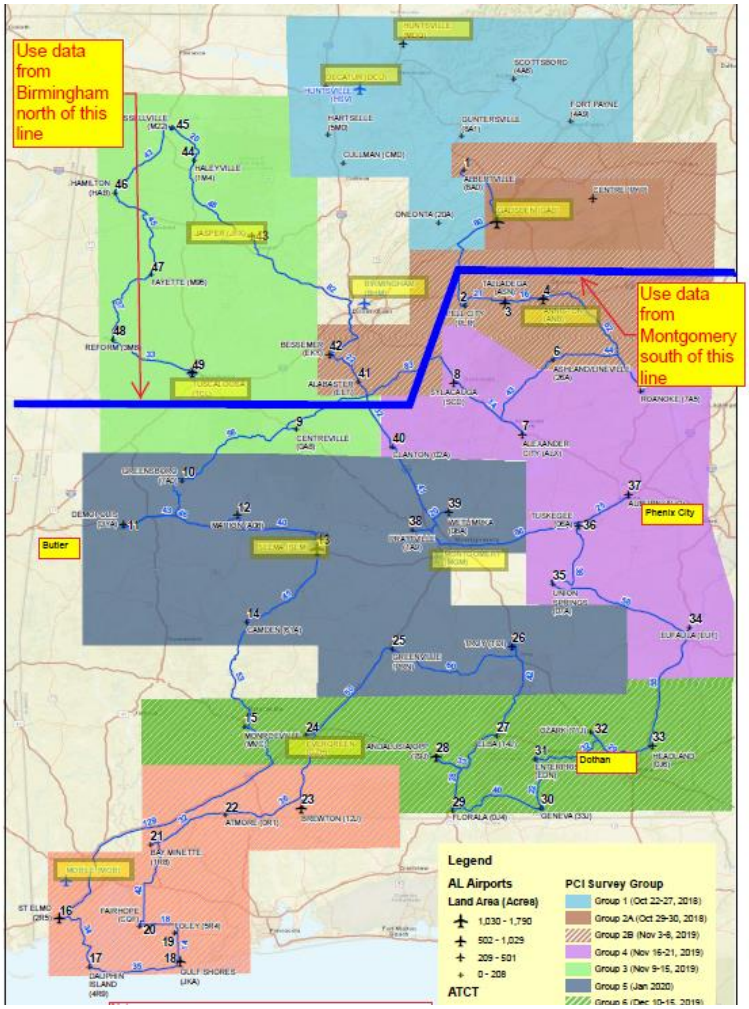

Figure 1: RSMeans Unit Costs Locations.

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 Critical Pavement Condition Index, denoted as CP in Table 1. The CP is based on the section's rank or 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

[1]For 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 Table 3 of the FAA's Advisory Circular 150/5320-6F. The pavement sections used for developing the cost estimates are:

- ≤ 12,500 lbs 4" P-403 (State HMA Mix) + 6" P-209 Base
- 12,500 – 30,000 lbs 4" P-403 (State HMA Mix) + 8" P-209 Base
- 30,000 – 100,000 lbs 5" P-401 + 10" P-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 the development of the unit costs for ALDOT's PMP update. However, based on the Engineer's future 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-direct pavement construction items were developed from API's extensive experience with 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 RSMeans 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		
		≤ 12.5	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		
		≤ 12.5	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	

Appendix H3
Airport Category

Region	City	FAA ID	Max Gross Weight (Thousand lbs)			Max GW	Category
			S	D	2D		
Birmingham	Reform	3M8	12.5	-	-	12.5	<= 12,500
	Fayette	M95	15.0	-	-	15.0	12,500-30,000
	Hamilton	HAB	15.0	-	-	15.0	12,500-30,000
	Scottsboro	4A6	15.0	-	-	15.0	12,500-30,000
	Alabaster	EET	16.0	-	-	16.0	12,500-30,000
	Centre-Piedmont	PYP	16.0	-	-	16.0	12,500-30,000
	Fort Payne	4A9	16.0	-	-	16.0	12,500-30,000
	Haleyville	1M4	20.0	-	-	20.0	12,500-30,000
	Hartselle	5M0	20.0	-	-	20.0	12,500-30,000
	Guntersville	8A1	24.0	-	-	24.0	12,500-30,000
	Cullman	CMD	30.0	-	-	30.0	12,500-30,000
	Russellville	M22	30.0	-	-	30.0	12,500-30,000
	Jasper	JFX	50.0	-	-	50.0	> 30,000
	Oneonta	20A	20.0	35.0	55.0	55.0	> 30,000
	Bessemer	EKY	60.0	60.0	-	60.0	> 30,000
	Albertville	8A0	60.0	90.0	130.0	130.0	> 30,000
	Madison	MDQ	60.0	75.0	140.0	140.0	> 30,000
	Decatur	DCU	75.0	125.0	150.0	150.0	> 30,000
	Tuscaloosa	TCL	61.0	87.0	168.0	168.0	> 30,000
	Gadsen	GAD	90.0	115.0	195.0	195.0	> 30,000
Montgomery	Florala	0J4	-	-	-	-	<= 12,500
	Elba	14J	4.0	-	-	4.0	<= 12,500
	Headland	0J6	12.0	-	-	12.0	<= 12,500
	Roanoke	7A5	12.0	-	-	12.0	<= 12,500
	Greenville	PRN	15.0	-	-	15.0	12,500-30,000
	Union Springs	07A	15.0	-	-	15.0	12,500-30,000
	Wetumpka	08A	15.0	-	-	15.0	12,500-30,000
	Atmore	0R1	16.0	-	-	16.0	12,500-30,000
	Clanton	02A	16.0	-	-	16.0	12,500-30,000
	Eufaula	EUF	16.0	-	-	16.0	12,500-30,000
	Geneva	33J	16.0	-	-	16.0	12,500-30,000
	Greensboro	7A0	16.0	-	-	16.0	12,500-30,000
	Centreville	0A8	18.0	-	-	18.0	12,500-30,000
	Ashland-Lineville	26A	20.0	-	-	20.0	12,500-30,000
	Sylacauga	SCD	20.0	-	-	20.0	12,500-30,000
	St. Elmo	2R5	23.0	-	-	23.0	12,500-30,000
	Ozark	71J	-	25.0	-	25.0	12,500-30,000
	Camden	61A	27.0	-	-	27.0	12,500-30,000
	Bay Minette	1R8	28.0	-	-	28.0	12,500-30,000
	Foley	5R4	28.0	-	-	28.0	12,500-30,000
	Tuskegee	06A	28.5	-	-	28.5	12,500-30,000

Appendix H3
Airport Category

Region	City	FAA ID	Max Gross Weight (Thousand lbs)			Max GW	Category
			S	D	2D		
Montgomery	Alexander City	ALX	30.0	-	-	30.0	12,500-30,000
	Dauphin Island	4R9	30.0	-	-	30.0	12,500-30,000
	Pell City	PLR	30.0	-	-	30.0	12,500-30,000
	Prattville	1A9	30.0	-	-	30.0	12,500-30,000
	Enterprise	EDN	-	-	-	-	> 30,000
	Evergreen	GZH	30.0	50.0	-	50.0	> 30,000
	Marion	A08	30.0	50.0	-	50.0	> 30,000
	Selma	SEM	33.0	54.0	-	54.0	> 30,000
	Fairhope	CQF	36.0	58.0	-	58.0	> 30,000
	Brewton	12J	40.0	60.0	-	60.0	> 30,000
	Demopolis	DYA	30.0	38.0	60.0	60.0	> 30,000
	Monroeville	MVC	70.0	-	-	70.0	> 30,000
	Auburn-Opelika	AUO	45.0	75.0	-	75.0	> 30,000
	Talladega	ASN	30.0	65.0	95.0	95.0	> 30,000
	Gulf Shores	JKA	80.0	100.0	-	100.0	> 30,000
	Troy	TOI	24.0	80.0	140.0	140.0	> 30,000
	Anniston	ANB	28.0	43.5	260.0	260.0	> 30,000
	Andalusia-OPP	79J	98.0	160.0	275.0	275.0	> 30,000

APPENDIX I

PAVEMENT CAPITAL IMPROVEMENT PROGRAM

I1: PCIP Summary
I2: Year 1 Maintenance Plan

Appendix I1

PCIP Summary

Hartselle-Morgan County Regional Airport (5M0)

Branch & Section	2021	2022	2023	2024	2025	2026	2027
A01-01	Preventive $1011.23 Before:78.78 After:78.78	Preventive $1140.7 Before:76.57 After:76.57	Preventive $1277.03 Before:74.36 After:74.36	Preventive $1420.51 Before:72.15 After:72.15	Required Project Major Above Critical $314885.03 Before:69.93 After:100	Preventive $122.68 Before:97.79 After:97.79	Preventive $252.73 Before:95.58 After:95.58
A01-02	StopGap $758.55 Before:59.78 After:59.78	StopGap $859.01 Before:57.57 After:57.57	StopGap $964.83 Before:55.36 After:55.36	StopGap $1076.21 Before:53.15 After:53.15	Required Project Major Below Critical $246832.46 Before:50.93 After:100	Preventive $96.17 Before:97.79 After:97.79	Preventive $198.11 Before:95.58 After:95.58
R1836-01	StopGap $4197.87 Before:64.78 After:64.78	StopGap $6715.58 Before:56 After:56	StopGap $8050.38 Before:51.74 After:51.74	Required Project Major Below Critical $1573662.75 Before:47.47 After:100	Preventive $403.61 Before:98.7 After:98.7	Preventive $808.17 Before:97.47 After:97.47	Preventive $1167.78 Before:96.45 After:96.45
TC01-01	StopGap $176.91 Before:53.83 After:53.83	StopGap $213.08 Before:49.15 After:49.15	StopGap $243.92 Before:45.81 After:45.81	Required Project Major Below Critical $69222.4 Before:43.74 After:100	Preventive $7.99 Before:98.97 After:98.97	Preventive $17.25 Before:97.85 After:97.85	Preventive $30.3 Before:96.33 After:96.33
TC02-01	Preventive $263.92 Before:70.53 After:70.53	StopGap $120.5 Before:67.32 After:67.32	StopGap $162.37 Before:63.41 After:63.41	Required Project Major Below Critical $54911.89 Before:58.84 After:100	Preventive $10.67 Before:98.97 After:98.97	Preventive $23.04 Before:97.85 After:97.85	Preventive $40.46 Before:96.33 After:96.33

Appendix I1

PCIP Summary

Hartselle-Morgan County Regional Airport (5M0)

Branch & Section	2021	2022	2023	2024	2025	2026	2027
THANG01-01	Preventive $508.28 Before:66.26 After:66.26	StopGap $196.98 Before:62.15 After:62.15	StopGap $253.81 Before:57.43 After:57.43	StopGap $313.99 Before:52.49 After:52.49	Required Project Major Below Critical $70403.61 Before:48.04 After:100	Preventive $12.64 Before:98.98 After:98.98	Preventive $27.56 Before:97.85 After:97.85
THANG01-02	StopGap $125.23 Before:63.61 After:63.61	StopGap $164.04 Before:59.07 After:59.07	StopGap $205.28 Before:54.14 After:54.14	StopGap $247.64 Before:49.43 After:49.43	Required Project Major Below Critical $50218.24 Before:45.95 After:100	Preventive $9.02 Before:98.98 After:98.98	Preventive $19.65 Before:97.85 After:97.85
THANG02-01	Preventive $321.4 Before:73.06 After:73.06	Preventive $360.89 Before:70.45 After:70.45	Preventive $553.28 Before:67.23 After:67.23	Major Below Critical $54208.93 Before:63.3 After:100	Preventive $14.12 Before:98.97 After:98.97	Preventive $30.51 Before:97.85 After:97.85	Preventive $53.57 Before:96.33 After:96.33
THANG02-02	Preventive $29.22 Before:98.35 After:98.35	Preventive $54.4 Before:97.01 After:97.01	Preventive $89.58 Before:95.22 After:95.22	Preventive $135.07 Before:93 After:93	Preventive $189.17 Before:90.48 After:90.48	Preventive $249.18 Before:87.83 After:87.83	Preventive $311.67 Before:85.22 After:85.22
TTRW18-01	StopGap $91.88 Before:63.61 After:63.61	StopGap $120.35 Before:59.07 After:59.07	StopGap $150.61 Before:54.14 After:54.14	Required Project Major Below Critical $33365.65 Before:49.43 After:100	Preventive $6.48 Before:98.97 After:98.97	Preventive $14 Before:97.85 After:97.85	Preventive $24.58 Before:96.33 After:96.33
TTRW36-01	StopGap $124.62 Before:57.99 After:57.99	StopGap $154.83 Before:53.04 After:53.04	StopGap $185.3 Before:48.5 After:48.5	Required Project Major Below Critical $57210.88 Before:45.5 After:100	Preventive $6.6 Before:98.97 After:98.97	Preventive $14.26 Before:97.85 After:97.85	Preventive $25.04 Before:96.33 After:96.33

Appendix I2

Localized Maintenance Plan

Hartselle-Morgan County Regional Airport (5M0)

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	1,216	Ft	2.59	No Localized M & R	0		$0.00	$0
A01	01	Preventive	48	L & T CR	Medium	1,001	Ft	2.13	Crack Sealing - AC	1,001	Ft	$3.95	$3,952
A01	01	Preventive	52	RAVELING	Low	938	SqFt	2	No Localized M & R	0		$0.00	$0
A01	02	Safety	48	L & T CR	Low	2,172	Ft	5.91	No Localized M & R	0		$0.00	$0
A01	02	Safety	48	L & T CR	Medium	1,984	Ft	5.4	No Localized M & R	0		$0.00	$0
A01	02	Safety	49	OIL SPILLAGE	N/A	112	SqFt	0.3	No Localized M & R	0		$0.00	$0
A01	02	Safety	57	WEATHERING	Medium	18,372	SqFt	50	No Localized M & R	0		$0.00	$0
A01	02	Safety	57	WEATHERING	Low	18,374	SqFt	50	No Localized M & R	0		$0.00	$0
R1836	01	Safety	48	L & T CR	Medium	12,271	Ft	4.55	No Localized M & R	0		$0.00	$0
R1836	01	Safety	48	L & T CR	Low	15,911	Ft	5.89	No Localized M & R	0		$0.00	$0
R1836	01	Safety	57	WEATHERING	Low	265,641	SqFt	98.41	No Localized M & R	0		$0.00	$0
TC01	01	Safety	43	BLOCK CR	Low	375	SqFt	5.55	No Localized M & R	0		$0.00	$0
TC01	01	Safety	48	L & T CR	Medium	500	Ft	7.4	No Localized M & R	0		$0.00	$0
TC01	01	Safety	48	L & T CR	Low	132	Ft	1.95	No Localized M & R	0		$0.00	$0
TC01	01	Safety	57	WEATHERING	Medium	3,380	SqFt	50	No Localized M & R	0		$0.00	$0
TC01	01	Safety	57	WEATHERING	Low	3,380	SqFt	50	No Localized M & R	0		$0.00	$0
TC02	01	Safety	48	L & T CR	Low	57	Ft	0.63	No Localized M & R	0		$0.00	$0
TC02	01	Safety	48	L & T CR	Medium	440	Ft	4.87	No Localized M & R	0		$0.00	$0
TC02	01	Safety	52	RAVELING	Low	428	SqFt	4.74	No Localized M & R	0		$0.00	$0
THANG01	01	Safety	48	L & T CR	Medium	254	Ft	2.42	No Localized M & R	0		$0.00	$0
THANG01	01	Safety	48	L & T CR	Low	356	Ft	3.4	No Localized M & R	0		$0.00	$0
THANG01	01	Safety	52	RAVELING	Low	1,330	SqFt	12.69	No Localized M & R	0		$0.00	$0
THANG01	01	Safety	57	WEATHERING	Low	4,576	SqFt	43.66	No Localized M & R	0		$0.00	$0
THANG01	01	Safety	57	WEATHERING	Medium	4,575	SqFt	43.65	No Localized M & R	0		$0.00	$0
THANG01	02	Safety	45	DEPRESSION	Medium	15	SqFt	0.2	No Localized M & R	0		$0.00	$0
THANG01	02	Safety	48	L & T CR	Medium	263	Ft	3.52	No Localized M & R	0		$0.00	$0
THANG01	02	Safety	48	L & T CR	Low	68	Ft	0.91	No Localized M & R	0		$0.00	$0
THANG01	02	Safety	50	PATCHING	Low	12	SqFt	0.16	No Localized M & R	0		$0.00	$0
THANG01	02	Safety	52	RAVELING	Low	205	SqFt	2.74	No Localized M & R	0		$0.00	$0

Appendix I2

Localized Maintenance Plan

Hartselle-Morgan County Regional Airport (5M0)

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	02	Safety	52	RAVELING	Medium	59	SqFt	0.78	No Localized M & R	0		$0.00	$0
THANG01	02	Safety	52	RAVELING	High	29	SqFt	0.39	No Localized M & R	0		$0.00	$0
THANG01	02	Safety	57	WEATHERING	Medium	7,172	SqFt	95.93	No Localized M & R	0		$0.00	$0
THANG02	01	Preventive	48	L & T CR	Medium	237	Ft	1.98	Crack Sealing - AC	237	Ft	$3.95	$936
THANG02	01	Preventive	49	OIL SPILLAGE	N/A	112	SqFt	0.93	Patching - AC Full-Depth	158	SqFt	$25.05	$3,957
THANG02	01	Preventive	52	RAVELING	Low	6,157	SqFt	51.51	No Localized M & R	0		$0.00	$0
THANG02	02	Preventive	49	OIL SPILLAGE	N/A	102	SqFt	0.59	Patching - AC Full-Depth	147	SqFt	$25.05	$3,689
TTRW18	01	Safety	48	L & T CR	Medium	326	Ft	5.94	No Localized M & R	0		$0.00	$0
TTRW18	01	Safety	48	L & T CR	Low	52	Ft	0.95	No Localized M & R	0		$0.00	$0
TTRW18	01	Safety	57	WEATHERING	Low	2,742	SqFt	49.99	No Localized M & R	0		$0.00	$0
TTRW18	01	Safety	57	WEATHERING	Medium	2,742	SqFt	49.99	No Localized M & R	0		$0.00	$0
TTRW36	01	Safety	48	L & T CR	Low	78	Ft	1.4	No Localized M & R	0		$0.00	$0
TTRW36	01	Safety	48	L & T CR	Medium	484	Ft	8.66	No Localized M & R	0		$0.00	$0
TTRW36	01	Safety	57	WEATHERING	Low	2,794	SqFt	50.01	No Localized M & R	0		$0.00	$0
TTRW36	01	Safety	57	WEATHERING	Medium	2,793	SqFt	49.99	No Localized M & R	0		$0.00	$0