2024 AIRPORT PAVEMENT CONDITION INDEX STUDY

STATEWIDE EXECUTIVE SUMMARY

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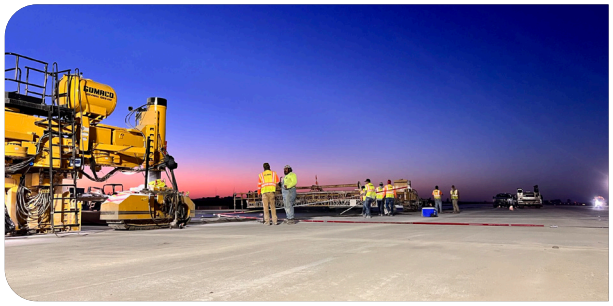
Overview

The Federal Aviation Administration (FAA) developed the Airport Pavement Management System (APMS) with the intent to provide a consistent and systematic approach to identify pavement needing maintenance or rehabilitation. The North Dakota Aeronautics Commission (NDAC) developed a customized APMS according to FAA requirements.



An APMS evaluates the current pavement condition and predicts a future condition based on the Pavement Condition Index (PCI). This allows the individual airports, the NDAC, and the FAA to monitor the condition of the airport pavements and budget for required maintenance to avoid excessive deterioration. The maintenance or rehabilitation timing is vital to support the crucial role airport pavement conditions play in safeguarding airport users.

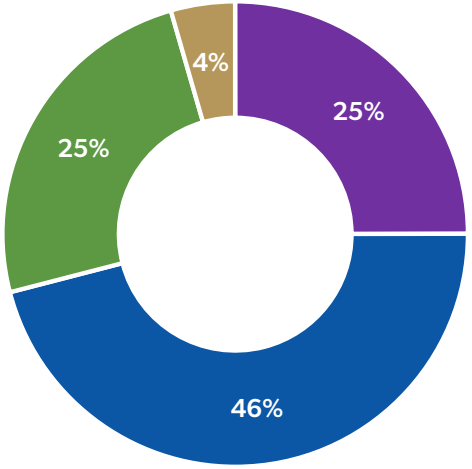
The North Dakota APMS is provided in an electronic format to make the data readily available. The APMS is updated every three years to accurately reflect pavement conditions across the state's airports. PCI results are used to build 5- and 10-year capital improvement plans (CIPs) with each airport's respective city, county, or airport authority.

In 2024, Mead & Hunt along with Applied Pavement Technology and Marr Arnold Planning conducted the update to the North Dakota APMS. As part of this update, the past three years of pavement history information was added to the online database, pavement inspections were completed, and functionality improvements were made to the website. This report includes the findings and recommendations of the APMS update. Full results can be found on the NDAC website, **WWW.AERO.ND.GOV**.

Pavement Inventory

In 2024, 72 airports were assessed. Of these, 54 were part of the National Plan of Integrated Airport Systems (NPIAS) and 18 were non-NPIAS. Of the 54 NPIAS airports assessed, 8 were commercial service and 46 were general aviation. Only NPIAS airports qualify for federal funding, so the FAA provided funding for the pavement inspections and reports for the NPIAS airports, while the NDAC solely funded the same work for the non-NPIAS airports. A PCI of 100 was assumed for all newly constructed pavement or pavement programmed to be reconstructed in the next year for airports statewide. Pavement inventory data includes area, age, surface type, and observed distresses. The map on page 5 identifies all North Dakota airports that were included in the 2024 APMS update.

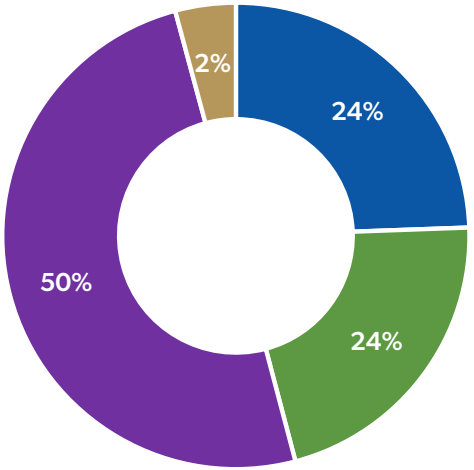
These airports represent 60.7 million square feet of concrete and asphalt pavement as summarized in the *Area by Use* and *Area by Surface Type* charts on this page. Pavement at the airports in the state **have an average age of 16 years for commercial service airports and 11 years for general aviation airports**. Throughout the years, the airports have performed preventive maintenance and carried out a series of rehabilitation/ reconstruction projects to eliminate foreign object debris (FOD) as well as sustain and extend the pavement life.



Area by Use

IN SQUARE FEET

Apron	15,293,673
Runway	28,185,830
Taxiway	15,038,259
T-Hangar	2,231,698



Area by Surface Type

IN SQUARE FEET

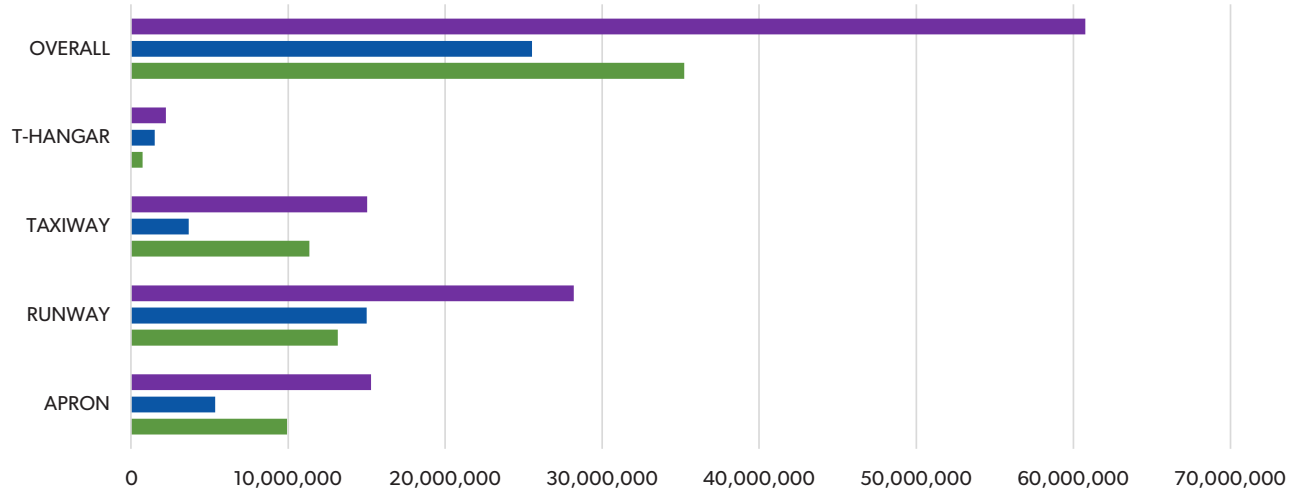
Asphalt Concrete	15,230,737
Asphalt Over Asphalt Concrete	13,382,375
Portland Cement Concrete	31,127,090
Asphalt Over Portland Cement Concrete	1,009,257

The charts shown below, *Pavement Area by Use* and *Area-Weighted Average Age by Use*, summarize the total square footage of pavements found in the state and the average age of those pavements based on use, broken out for the overall state system, commercial service airports, and general aviation airports.

Pavement Area by Use

IN SQUARE FEET

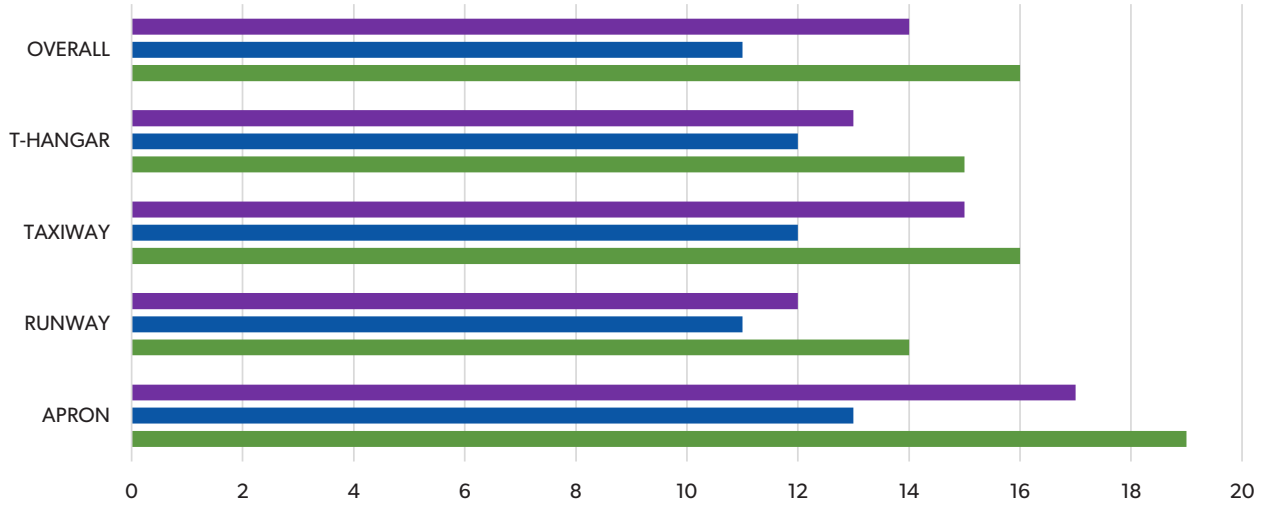
- **Overall State Airport System**
- **General Aviation Airports**
- **Commercial Service Airports**



Area-Weighted Average Age by Use

IN SQUARE FEET

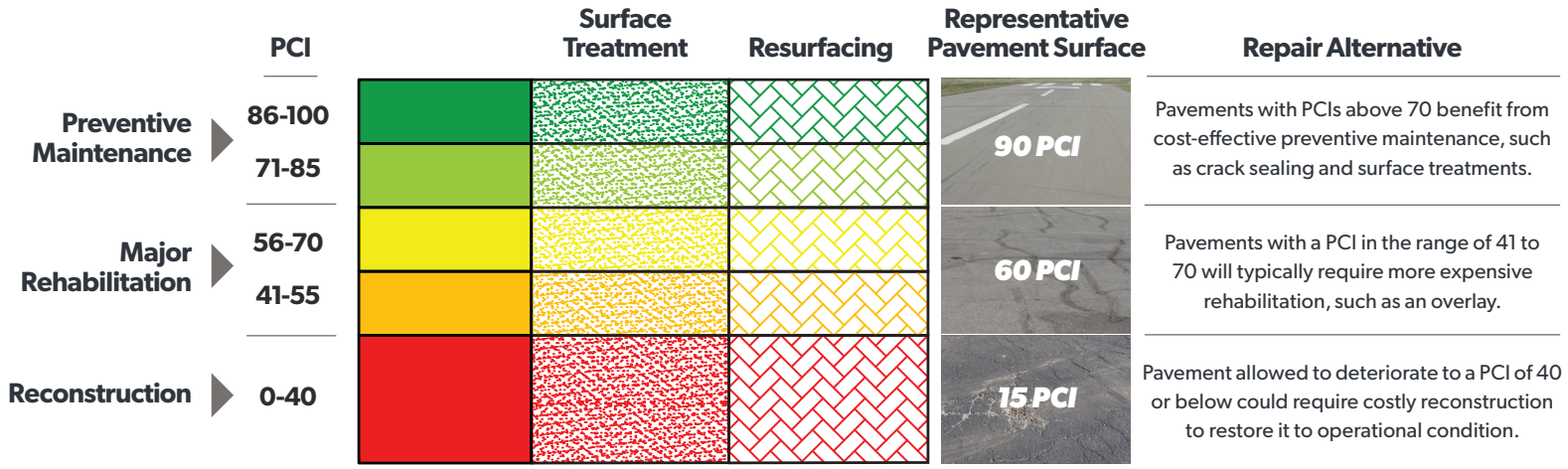
- **Overall State Airport System**
- **General Aviation Airports**
- **Commercial Service Airports**



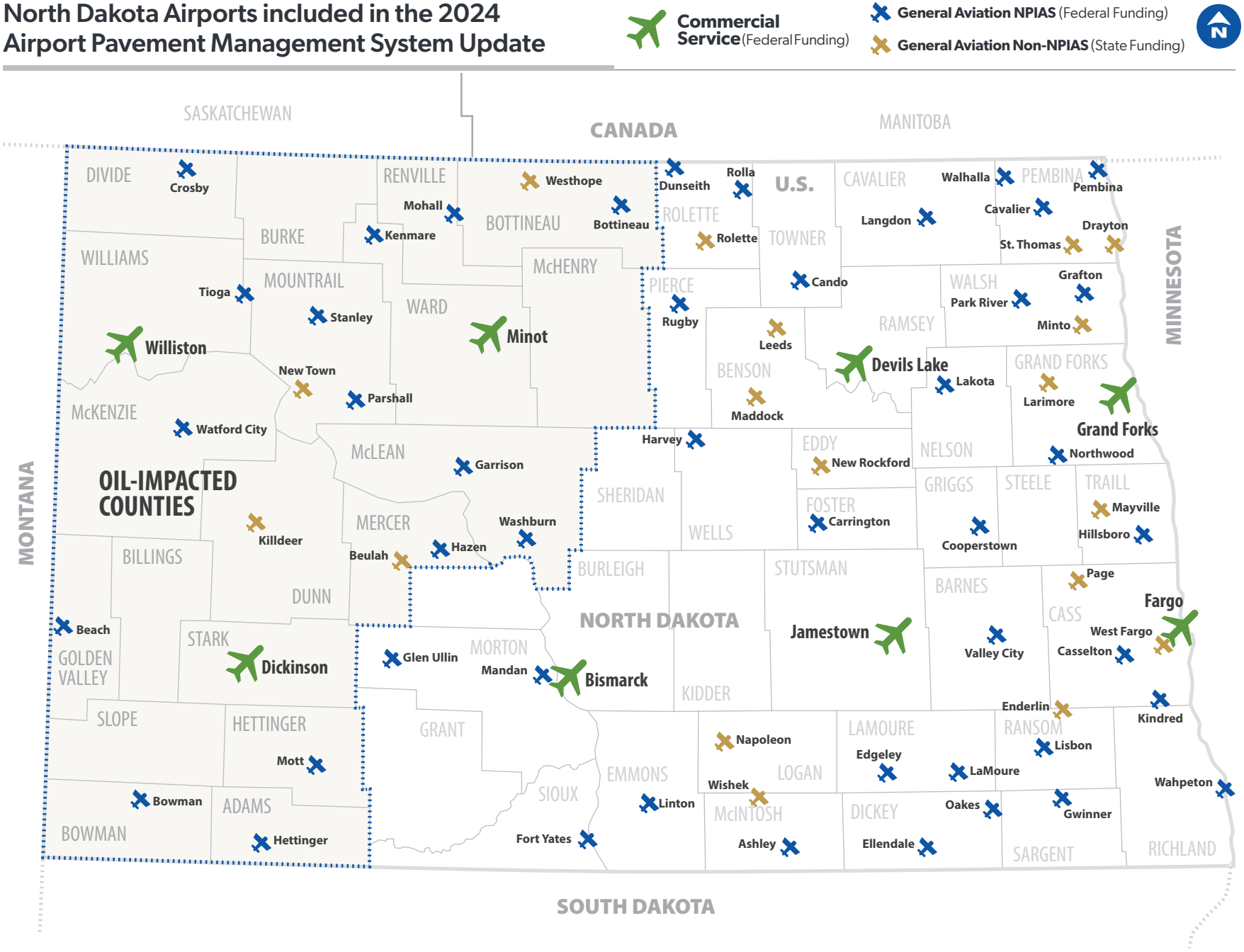
Pavement Evaluation Procedure

A PCI survey was conducted according to the procedures outlined in American Society for Testing and Materials (ASTM) Standard D5340, *Standard Test Method for Airport Pavement Condition Index Surveys*, and the FAA's Advisory Circular 150/5380-6C, *Guidelines and Procedures for Maintenance of Airport Pavements*. A PCI survey consists of dividing pavement sections into a series of sample units, selecting systematically random sample units for inspection, and collecting the distress data within the sample units to determine overall pavement deterioration. Pavement deterioration is based on quantifying the different distress types, the severities, and the amount of distress present in the samples for each section. This information is then used to formulate a composite index numerical value that represents the overall pavement condition. This value will range from 0 (failed) to 100 (excellent).

As part of the APMS, the PCI will be used to determine current pavement conditions, predict future conditions, develop a maintenance program, and identify the most cost-effective time frame to perform major rehabilitation. The PCI will also aid in tracking and determining causes of deterioration on a pavement. The correlation between a PCI number and a recommended repair is shown in the illustration below. Preventive maintenance consists of patching, crack sealing, and joint sealing. Pavement rehabilitation includes surface treatments and thin overlays. Pavement reconstruction refers to full-depth reconstruction and thick overlays. Surface treatments are used to address weathering and low-severity raveling. Nominal resurfacing is used to address medium- and high-severity raveling.



North Dakota Airports included in the 2024 Airport Pavement Management System Update



Typical Pavement Distress Types

The FAA Advisory Circular provides a list of specific distresses to be analyzed and recorded when inspecting pavement. Airports in North Dakota are a combination of asphalt concrete (AC) pavement and Portland cement concrete (PCC) pavement with there being slightly more PCC pavement than AC pavement. These two pavement types have unique pavement distresses and repairs. The following is a brief description of commonly observed pavement distresses at North Dakota airports.

ALLIGATOR CRACKING.

Alligator (fatigue) cracking is a load-related distress caused by excessive tensile strains at the bottom of the AC layer or stabilized asphalt base layer from repeated aircraft loadings. Alligator cracking typically shows up on the surface as a series of parallel cracks, which eventually interconnect to form a pattern resembling the skin of an alligator.

DURABILITY CRACKING.

Durability cracking in PCC pavement usually appears as a series of parallel cracks adjacent to a joint or crack. This is caused by environmental factors such as freeze-thaw cycles and the concrete's inability to withstand them.

WEATHERING.

As pavements age and are exposed to oxidation and other environmental stresses, they may experience a loss in the material making up the pavement matrix. Weathering is the loss of asphalt binder and fine aggregate in the surface of the pavement. The loss of fine matrix material in the surface may eventually lead to the exposure and dislodging of coarse aggregate, leading to raveling and FOD.

ANALYZING

PAVEMENT DISTRESS

LONGITUDINAL AND TRANSVERSE (L&T) CRACKING.

The predominant distress type found on asphalt pavements at North Dakota airports is L&T cracking. This distress can be caused by any of the following: (1) separation of pavement at paving lane joints, (2) shrinkage of AC pavement due to temperature differentials in older or brittle pavements, or (3) reflection cracking from underlying faults in supportive layers of pavement or subgrade. Cracking is also common for PCC pavement, and is caused by a combination of load repetition, curling stresses, and shrinkage stresses.

RAVELING.

As pavements age and are exposed to oxidation and other environmental stresses, they may experience a loss in the material making up the pavement matrix. Raveling is the dislodging and loss of coarse aggregate in the surface of a pavement. The pavement may be showing signs of aging and hardening and may result in the production of FOD.

SPALLING.

Spalling in PCC pavement is the breakdown of the slab edges near the slab joint. Spalling is identified as occurring in the corner or along the joint of a PCC slab. Spalling is typically caused by the introduction of incompressible material in the joint, weaker pavement at the joint caused by overworking of the pavement during construction, traffic loading, or a combination of these.

Pavement Classification Rating (PCR)

A PCR is a value assigned to a pavement that expresses its relative load-carrying capacity in terms of allowable load for unrestricted operations, based on the analyzed aircraft traffic, the pavement's layer properties, and subgrade strength. Runway pavements at the commercial service airports were analyzed in 2024 to provide a PCR value as detailed in FAA Advisory Circular 150/5335-5D, *Standardized Method of Reporting Airport Pavement Strength – PCR*. The PCR is expressed as a five-part code. The first part of the PCR is a numerical value indicating the load-carrying capacity of the pavement. This numerical value is followed by four codes representing the following categories:

- **Pavement Type**
  - R = Rigid
  - F = Flexible
- **Subgrade Strength**
  - A = High (E ≥ 21,756 psi)
  - B = Medium (14,504 psi ≤ E < 21,756 psi)
  - C = Low (8,702 psi ≤ E < 14,504 psi)
  - D = Ultra Low (E < 8,702 psi)
- **Maximum Allowable Tire Pressure**
  - W = Unlimited (no pressure limit)
  - X = High (pressure limited to 254 psi)
  - Y = Medium (pressure limited to 181 psi)
  - Z = Low (pressure limited to 73 psi)
- **Pavement Evaluation Method**
  - T = Technical Evaluation
  - U = Using Aircraft Evaluation

The table below contains the PCR values for the runways at the eight commercial service airports that were analyzed during the 2024 APMS update. A detailed PCR report for each commercial service airport can be found on the NDAC website, **WWW.AERO.ND.GOV**. Instructions for accessing the PCI Study section of the website are included on page 9 of this report. PCR information can be found under Airport Details.

PCR Results

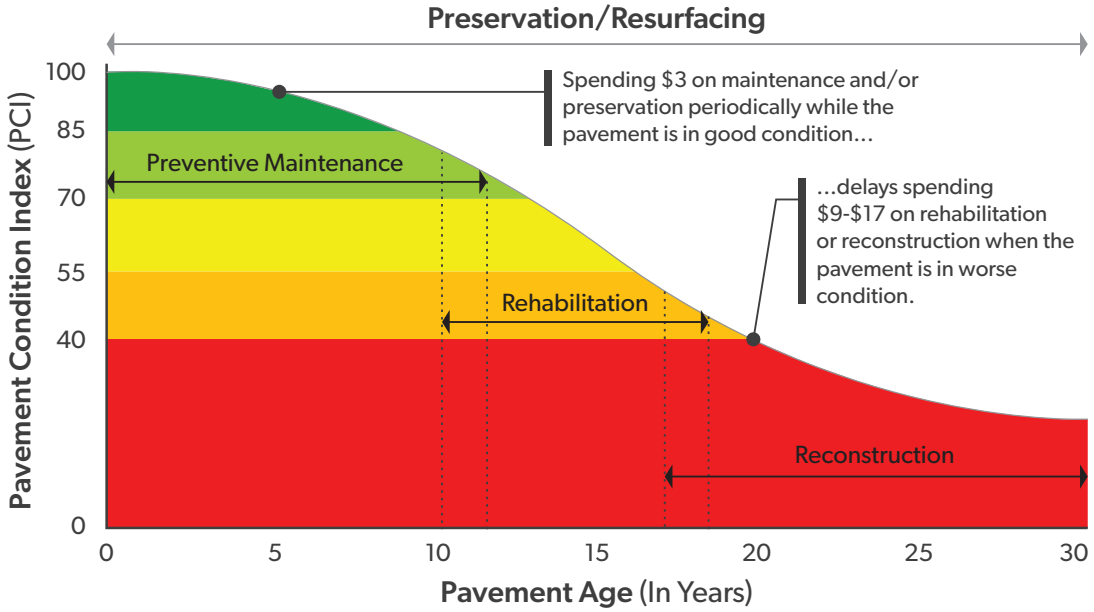
AIRPORT	RUNWAY	PCR
Bismarck Municipal Airport	Runway 13-31	750/R/D/W/T
	Runway 3-21	430/F/D/X/T
Devils Lake Regional Airport	Runway 13-31	240/F/D/X/T
	Runway 3-21	50/F/D/X/T
Dickinson Theodore Roosevelt Regional Airport	Runway 14-32	350/R/D/W/T
	Runway 7-25	60/F/D/X/T
Fargo - Hector International Airport	Runway 18-36	830/R/D/W/T
	Runway 9-27	340/R/D/W/T
	Runway 13-31	70/R/D/W/T
Grand Forks International Airport	Runway 17L-35R	800/F/D/X/T
	Runway 9L-27R	570/R/C/W/T
Jamestown Regional Airport	Runway 13-31	490/F/C/X/T
	Runway 4-22	80/F/D/X/T
Minot International Airport	Runway 13-31	670/R/D/W/T
	Runway 8-26	180/F/D/X/T
Williston Basin International Airport	Runway 14-32	610/R/D/W/T

Analysis of Results

Critical PCI Values

For each year of the analysis, the future condition of each of the pavements was estimated based on pavement performance models. The next step was to determine whether preventive maintenance or major rehabilitation/reconstruction was the appropriate and most cost-effective method of maintaining pavement life. If a pavement was projected to be above the critical PCI values listed below, the pavement was recommended for preventive maintenance. Major rehabilitation/ reconstruction was recommended for any PCI value below the PCI critical thresholds. Surface treatments were identified for viable candidates that exhibited weathering and/or raveling. These were identified separate from the critical value analysis.

- **60 for general aviation taxiways and aprons**
- **65 for commercial service taxiways and aprons**
- **70 for general aviation runways**
- **75 for commercial service runways**



Interested in a Particular Airport's Pavement Condition & History?

For information on pavement conditions for a specific airport, visit the Interactive Data Exchange Application (IDEA) website by going to **WWW.AERO.ND.GOV** and navigating to "**Studies**" then "**Pavement Condition Index**" then "**Click Here.**" Once there, you can view a list of the distresses that were identified as well as a maintenance and rehabilitation plan for each airport. The IDEA site also contains photos of each airport and an interactive version of the airport's PCI map.

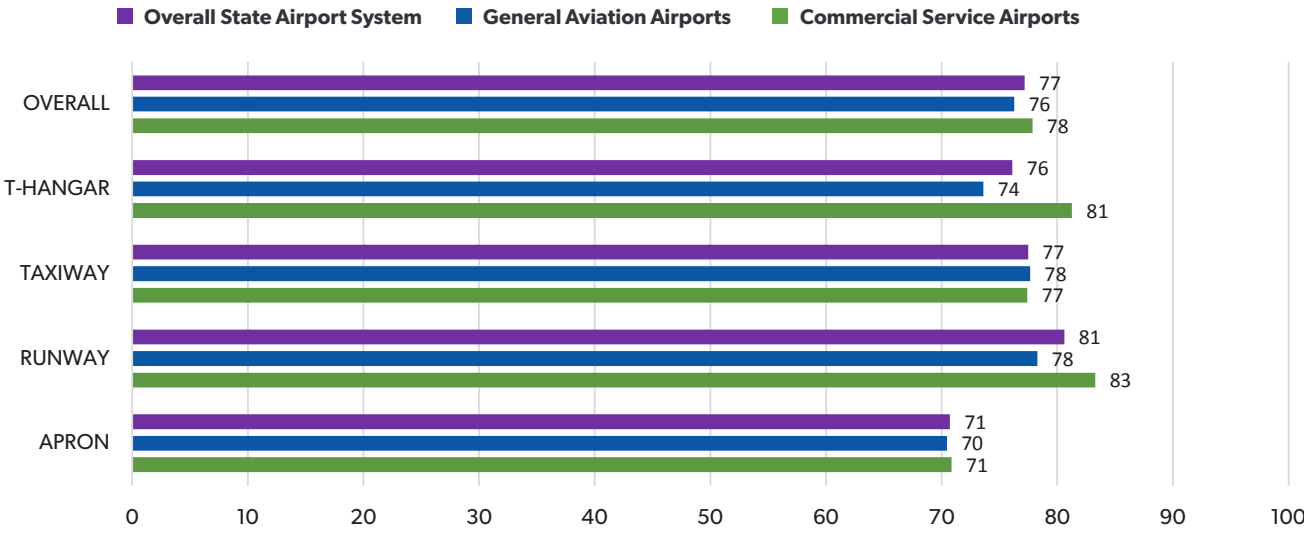
Overall Pavement Condition

Each airport was inspected, and an overall area-weighted pavement condition was assigned to each. The information collected at each airport is used to provide greater detail on the uses of pavements and the correlating PCI value associated with each use. The overall area-weighted PCI of all the airports included in this study is 77. The *Area-Weighted Average PCI Value by Use* chart shows the 2024 condition of the pavement broken out by use and airport classification.

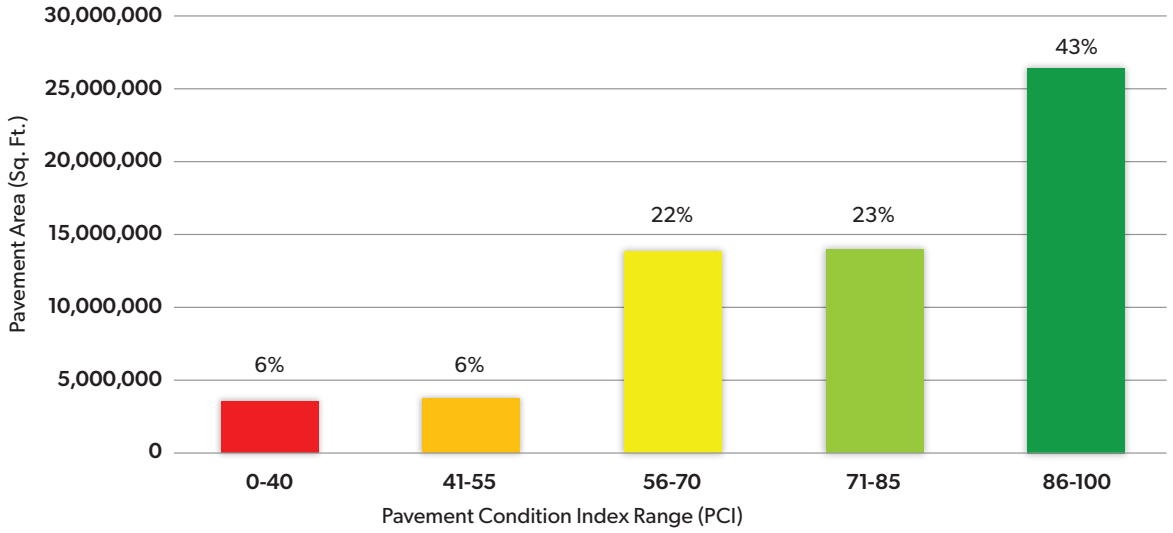
The *Total Statewide Pavement Area by PCI Range (All Airports)* chart depicts the amount of the state's airport pavement (in square feet) that falls into each PCI range. The *Overall Area-Weighted PCI* table on the next page provides the area-weighted PCI for each airport, which is comprised of all pavements on the airport.

Area-Weighted Average PCI Value by Use

BY PCI INDEX



Total Statewide Pavement Area by PCI Range (All Airports)



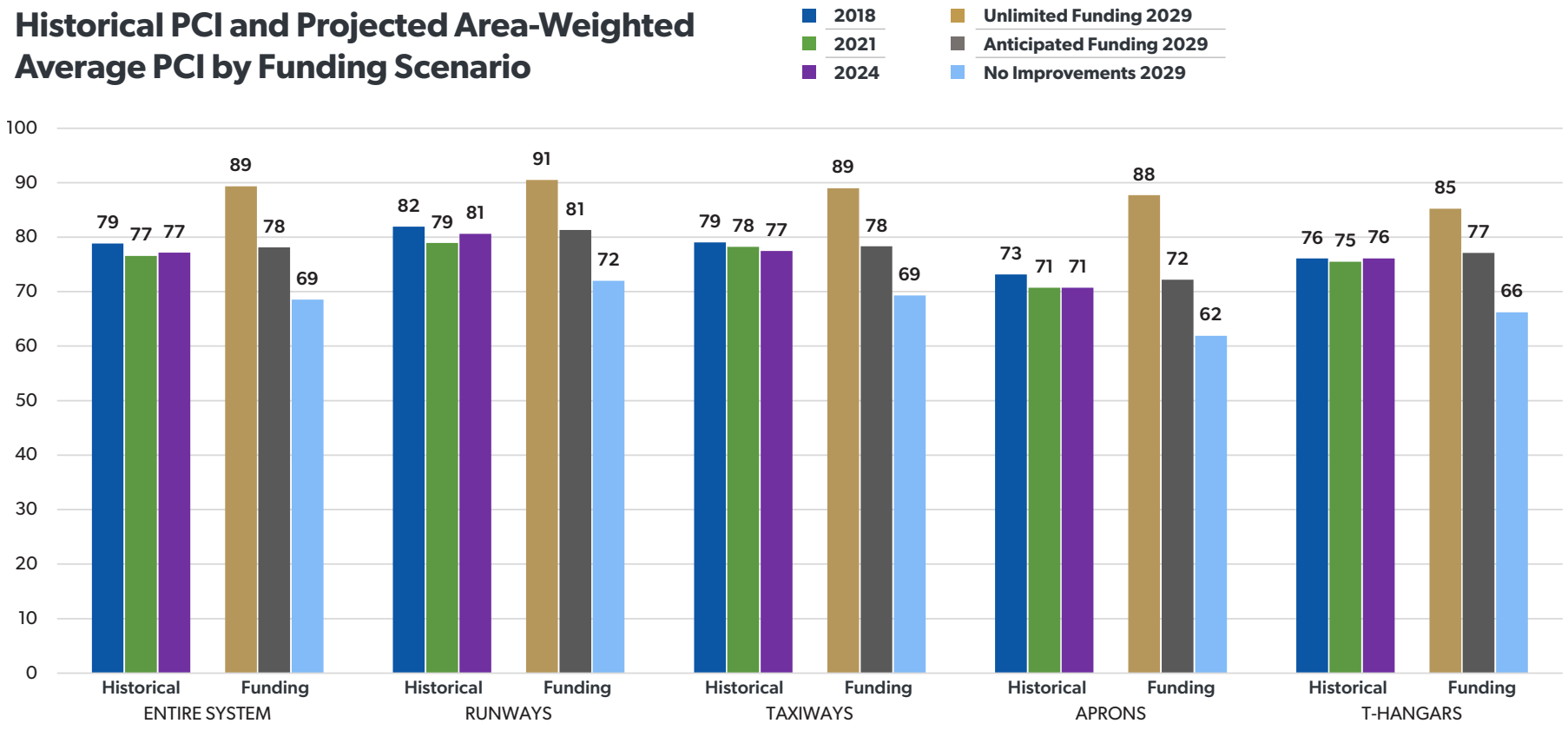
Overall Area-Weighted PCI

AIRPORT NAME	AREA-WEIGHTED PCI
Ashley Municipal	74
Beach	88
Beulah Municipal	73
Bismarck Municipal	74
Bottineau Municipal	81
Bowman Regional	93
Cando Municipal	87
Carrington Municipal	83
Casselton - Robert Miller Regional	48
Cavalier Municipal	54
Cooperstown Municipal	63
Crosby Municipal	95
Devils Lake Regional	66
Dickinson Theodore Roosevelt Regional	83
Drayton Municipal	74
Dunseith - International Peace Garden	98
Edgeley Municipal	79
Ellendale Municipal	88
Enderlin - Sky Haven	70
Fargo - Hector International	72
Fort Yates - Standing Rock	34
Garrison Municipal	86
Glen Ullin Regional	97
Grafton Hutson Field	66
Grand Forks International	78
Gwinner-Roger Melroe Field	79
Harvey Municipal	79
Hazen - Mercer County Regional	86
Hettinger - JB Lindquist Regional	72
Hillsboro Regional	95
Jamestown Regional	82
Kenmare Municipal	83
Killdeer - Dunn County	83
Kindred - Robert Odegaard Field	67
Lakota Municipal	76
LaMoure Rott Municipal	76
Langdon - Robertson Field	70
Larimore Municipal	63
Leeds Municipal	99
Linton Municipal	83
Lisbon Municipal	65
Maddock Municipal	90
Mandan Regional - Lawler Field	81
Mayville Municipal	73
Minot International	78
Minto Municipal	71
Mohall Municipal	77
Mott Municipal	65
Napoleon Municipal	79
New Rockford - Tomlinson Field	100
New Town Municipal	80
Northwood Municipal - Vince Field	79
Oakes Municipal	78
Page Regional	44
Park River - W. C. Skjerven Field	57
Parshall-Hankins	64
Pembina Municipal - Thomas Nord Field	82
Rolette	73
Rolla Municipal	65
Rugby Municipal	68
St. Thomas Municipal	62
Stanley Municipal	74
Tioga Municipal	69
Valley City - Barnes County Municipal	75
Wahpeton - Harry Stern	78
Walhalla Municipal	45
Washburn Municipal	90
Watford City Municipal	96
West Fargo Municipal	52
Westhope Municipal	97
Williston Basin International	98
Wishek Municipal	71

Historic Pavement Condition

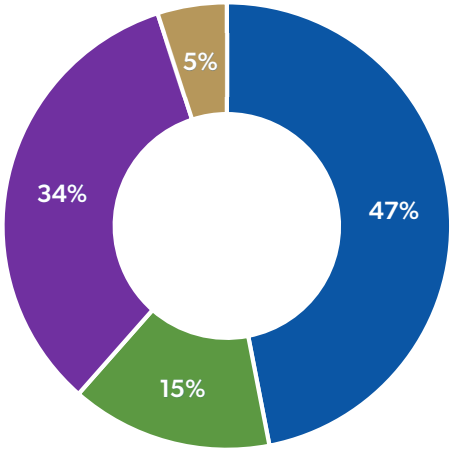
The APMS is updated every three years. It is important to track how the system as a whole is performing from update to update. Overall, the statewide airport system PCI will experience cyclical ups and downs for a variety of reasons including but not limited to large amounts of new pavement added to the system, timing and availability of project funding, and the types of distresses observed on pavements. The *Historical PCI and Projected Area-Weighted Average PCI by Funding Scenario* chart below provides a summary of the 2018 and 2021 historic PCI values; current 2024 PCI values; and projected 2029 PCI values under the following scenarios: unlimited funding; anticipated state budget funding; and no improvements completed on the existing system.

Historical PCI and Projected Area-Weighted Average PCI by Funding Scenario



Pavement Condition Distribution

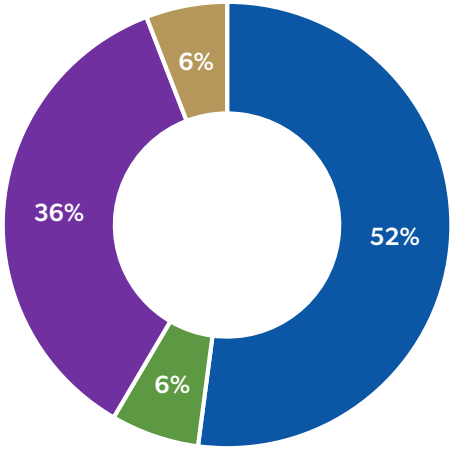
The overall state airport system chart below summarizes the data for the airports included in the 2024 APMS. Approximately 47 percent have PCIs indicating they will benefit from preventive maintenance actions, such as crack sealing, joint sealing, and patching. Roughly 15 percent would benefit from applying a surface treatment. Approximately 34 percent of the pavement infrastructure needs more extensive rehabilitation, while 5 percent needs reconstruction to restore the pavement. This same information is provided for the commercial service and general aviation airports in the charts below.



Overall State Airport System

IN SQUARE FEET

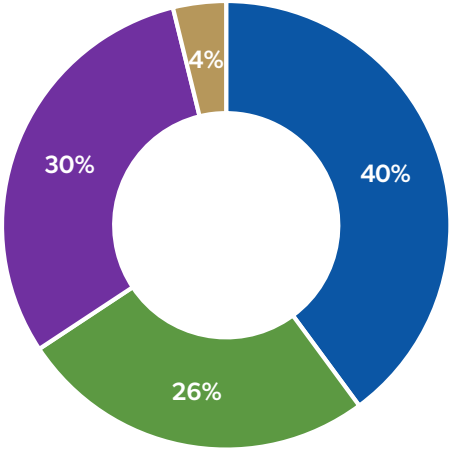
Preventative Maintenance	28,520,697
Surface Treatments	8,837,823
Major Rehabilitation	20,352,480
Major Reconstruction	3,038,459



Commercial Service Airports

IN SQUARE FEET

Preventative Maintenance	18,338,161
Surface Treatments	2,243,232
Major Rehabilitation	12,572,167
Major Reconstruction	2,062,688



General Aviation Airports

IN SQUARE FEET

Preventative Maintenance	10,182,536
Surface Treatments	6,594,591
Major Rehabilitation	7,780,313
Major Reconstruction	975,771

Pavement Funding Assessment

Funding for aviation projects within the state is crucial to maintain a steady pavement condition and safeguard aviation users. If no funding is provided for pavement maintenance and repair, North Dakota's pavement system will experience a slow and steady decline in condition. This decline would create a need for more major rehabilitation or reconstruction projects, which in turn significantly increases future cost.

Using the information collected during the pavement inspection, a rehabilitation program for 2025 through 2029 was developed for every airport in the study. A five-year program was prepared with the goal of maintaining the pavement above the established critical PCI values listed earlier in this report. The program generates a major rehabilitation recommendation for pavement in the year they drop below their critical PCI.

If all projects identified in the PCI study were funded, an approximate total of $290.1 million would be needed during the next five years – $196.7 million for commercial service airports and $93.4 million for general aviation airports. The unlimited budget funding for individual airport needs through 2029 is summarized in the table shown to the right, *Five-Year Funding Plan*. This analysis is for 2025 through 2029 with an inflation factor of 4 percent for each year when calculating future cost of work. The unit costs used to estimate overall project costs are based on averages of recent projects completed throughout the state. These costs are averages and are not intended to be used for specific project planning purposes. Funding needs identified in an unlimited budget scenario are to maintain or rehabilitate existing infrastructure and do not include any additional needs or improvements made.

Five-Year Funding Plan

CLASSIFICATION	AIRPORT NAME	5-YEAR TOTAL FUNDING NEEDS
Commercial Service	Bismarck Municipal Airport	$37,855,133
	Devils Lake Regional Airport	$8,386,285
	Dickinson Theodore Roosevelt Regional Airport	$10,951,973
	Fargo - Hector International Airport	$72,381,714
	Grand Forks International Airport	$35,609,872
	Jamestown Regional Airport	$9,529,794
	Minot International Airport	$21,945,987
	Williston Basin International Airport	$97,288
Five-Year Commercial Service Total		**$196,758,046**
General Aviation (NPIAS)	Ashley Municipal Airport	$163,698
	Beach Airport	$2,456,103
	Bottineau Municipal Airport	$372,455
	Bowman Regional Airport	$613,971
	Cando Municipal Airport	$287,165
	Carrington Municipal Airport	$1,352,236
	Casselton - Robert Miller Regional Airport	$21,504,006
	Cavalier Municipal Airport	$4,245,185
	Cooperstown Municipal Airport	$2,429,895
	Crosby Municipal Airport	$286,976
	Dunseith - International Peace Garden Airport	$179,432
	Edgeley Municipal Airport	$896,565
	Ellendale Municipal Airport	$121,261
	Fort Yates - Standing Rock Airport	$743,387
	Garrison Municipal Airport	$72,548
	Glen Ullin Regional Airport	$76,727
	Grafton Hutson Field Airport	$2,383,057
	Gwinner-Roger Melroe Field Airport	$3,864,048
	Harvey Municipal Airport	$529,957

CLASSIFICATION	AIRPORT NAME	5-YEAR TOTAL FUNDING NEEDS
General Aviation (NPIAS)	Hazen - Mercer County Regional Airport	$159,005
	Hettinger - JB Lindquist Regional Airport	$1,948,323
	Hillsboro Regional Airport	$72,596
	Kenmare Municipal Airport	$204,035
	Kindred - Robert Odegaard Field Airport	$3,864,310
	Lakota Municipal Airport	$1,652,678
	LaMoure Rott Municipal Airport	$369,299
	Langdon - Robertson Field Airport	$394,776
	Linton Municipal Airport	$105,985
	Lisbon Municipal Airport	$2,106,105
	Mandan Regional Airport - Lawler Field	$2,857,941
	Mohall Municipal Airport	$657,569
	Mott Municipal Airport	$1,093,830
	Northwood Municipal - Vince Field Airport	$421,903
	Oakes Municipal Airport	$468,906
	Park River Airport - W.C. Skjerven Field	$1,566,928
	Parshall-Hankins Airport	$1,539,616
	Pembina Municipal -Thomas Nord Field	$17,452
	Rolla Municipal Airport	$1,690,211
	Rugby Municipal Airport	$1,212,178
	Stanley Municipal Airport	$714,062
	Tioga Municipal Airport	$5,607,388
	Valley City - Barnes County Municipal Airport	$2,669,808
	Wahpeton - Harry Stern Airport	$4,688,750
	Walhalla Municipal Airport	$288,775
	Washburn Municipal Airport	$308,776
	Watford City Municipal Airport	$75,925
Five-Year General Aviation NPIAS Total		**$79,335,802**

CLASSIFICATION	AIRPORT NAME	5-YEAR TOTAL FUNDING NEEDS
General Aviation (Non-NPIAS)	Beulah Municipal Airport	$1,190,526
	Drayton Municipal Airport	$292,344
	Enderlin - Sky Haven Airport	$787,648
	Killdeer - Dunn County Airport	$0
	Larimore Municipal Airport	$1,161,585
	Leeds Municipal Airport	$0
	Maddock Municipal Airport	$85,252
	Mayville Municipal Airport	$971,269
	Minto Municipal Airport	$503,224
	Napoleon Municipal Airport	$514,328
	New Rockford - Tomlinson Field Airport	$0
	New Town Municipal Airport	$54,894
	Page Regional Airport	$1,831,269
	Rolette Airport	$1,052,056
	St. Thomas Municipal Airport	$1,095,060
	West Fargo Municipal Airport	$2,851,674
	Westhope Municipal Airport	$460,775
	Wishek Municipal Airport	$1,189,282
Five-Year General Aviation Non-NPIAS Total		**$14,041,186**
FIVE-YEAR STATEWIDE FUNDING TOTAL		**$290,135,034**

No or minimal five-year funding needs are due to the airport recently completing a pavement preservation project, construction, reconstruction, or rehabilitation.

Summary

This report summarizes the results of the pavement evaluation conducted in North Dakota as part of the state APMS database update for airports. This includes 8 NPIAS commercial service airports, 46 NPIAS general aviation airports, and 18 non-NPIAS general aviation airports. The system currently has 60.7 million square feet of pavement – 35.2 million square feet at commercial service airports and 25.5 million square feet at general aviation airports. **In 2021, the weighted PCI value for the overall state airport system pavement network was 77. Based on visual pavement inspections in 2024, the current weighted PCI was determined to be 77.** If no funding is provided, this PCI value will steadily fall to 69 by the end of 2029. If the funding anticipated in the state budget is provided, the 2029 overall PCI value of the system is anticipated to be 78 . If all work identified were to be completed, the 2029 overall PCI of the system is anticipated to increase to a value of 89.

Approximately $290.1 million in funding would be needed over the next five years to complete all work that has been identified in the unlimited budget scenario. This includes approximately $196.7 million for commercial service airports and $93.4 million for general aviation airports. Additional information can be found by visiting the NDAC website, **WWW.AERO.ND.GOV**.

NORTH DAKOTA AERONAUTICS COMMISSION

To learn more about the 2024 Airport Pavement Condition Index Study, visit WWW.AERO.ND.GOV.

2024 AIRPORT PAVEMENT CONDITION INDEX STUDY

STATEWIDE EXECUTIVE SUMMARY

2024