North Dakota Airport Pavement Management System Update

Prepared for: North Dakota Aeronautics Commission

2012 Executive Summary

ACKNOWLEDGEMENT

This document was prepared under the guidance of

North Dakota Aeronautics Commission
Kyle C. Wanner – Aviation Planner
701-328-9650
www.nd.gov/ndaero

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Prepared by:

Ulteig Engineers Inc.
3350 38th Ave South
Fargo ND, 58104
888-858-3441
www.ulteig.com

Applied Pavement Technology, Inc.
115 West Main Street, Suite 400
Urbana, Illinois 61801
217-398-3977
www.appliedpavement.com

EVS, Inc.
10250 Valley View Rd. Ste 123
Eden Prairie, MN 55344
www.evs-eng.com

OVERVIEW

Background

The North Dakota Aeronautics Commission (NDAC) developed an Airport Pavement Management System (APMS) in accordance with Federal Aviation Administration (FAA) requirements. This system is updated every three years to accurately reflect current pavement conditions across the state's airports. The ultimate goals of the current project were to update the existing APMS and to provide the information electronically to allow for the data to be readily available to the airports, FAA and NDAC to assist in the following:

- Easily identify pavement-related needs
- Optimize project selection based on pavement-related needs
- Develop a pavement management plan
- Understand the impacts of the pavement management plan developed from the APMS information

Of utmost importance, was to develop a final APMS that would easily convey the information compiled during this Pavement Condition Index study, develop a permanent record of work history at each airport and allow for future updates all the while maintaining and building a database of record information.

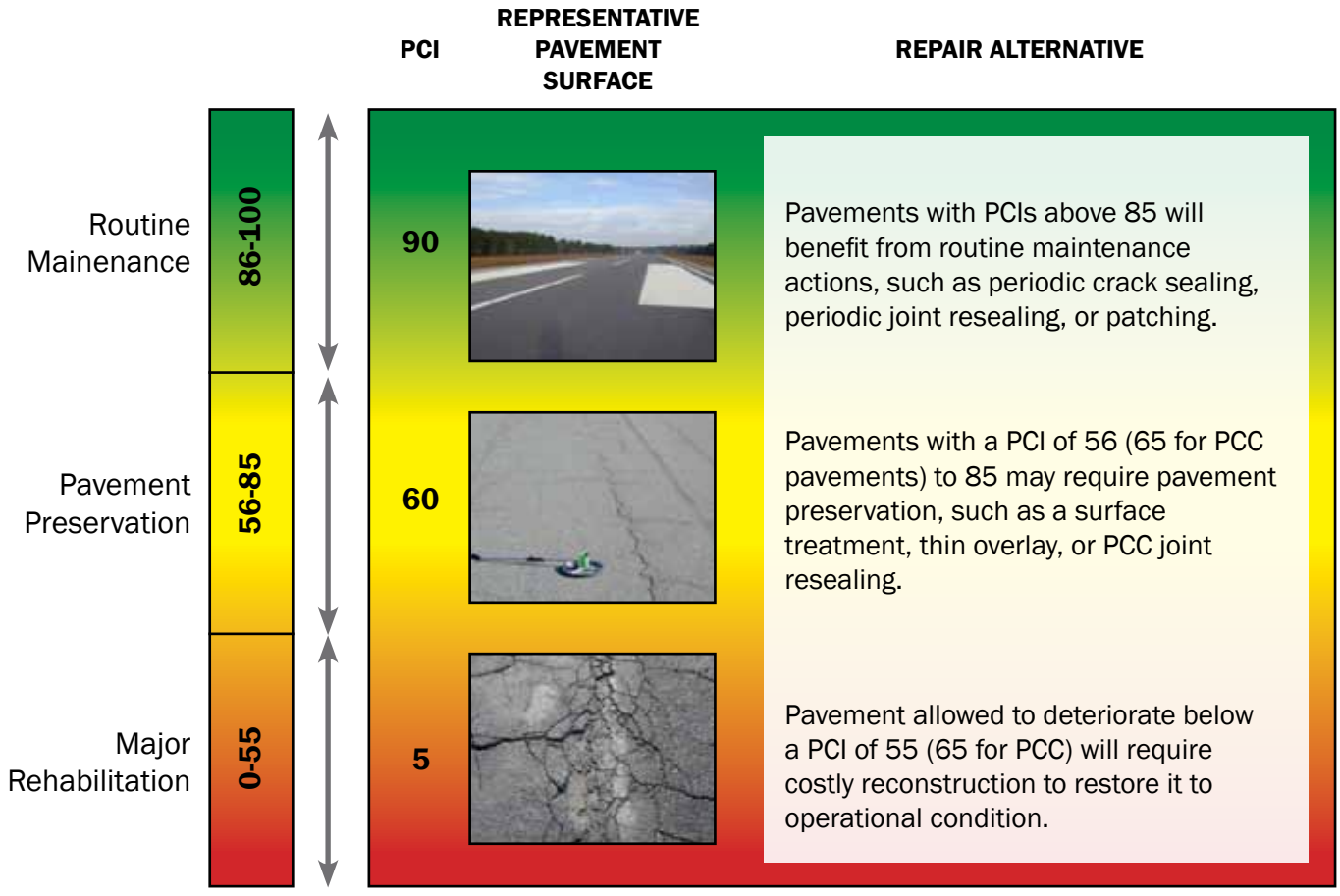
Ulteig along with Applied Pavement Technology, Inc. and EVS, Inc. conducted an update to the APMS in 2012. The findings and recommendations of the APMS update are included in this report. Full results can be found online on the NDAC website, www.nd.gov/ndaero.

Airport Pavement Management System

The Airport Pavement Management System was developed by the FAA and is intended to provide a consistent and systematic approach to identifying pavement that is in need of maintenance or rehabilitation. An APMS evaluates both the current condition of the pavement as well as predicts a future condition based on the Pavement Condition Index (PCI). This in turn allows the individual airports, NDAC and the FAA to monitor the condition of the airport pavements and budget for required maintenance to avoid excessive deterioration. The timing of this maintenance or rehabilitation is vital as airport pavement conditions play a crucial role in ensuring the safety of all airport users.

Pavement Condition Index (PCI)

A pavement condition index survey was conducted in accordance with the procedures outlined in American Society for Testing and Materials (ASTM) Standard D5340-11, Standard Test Method for Airport Pavement Condition Index Surveys and the FAA's Advisory Circular 150/5380-6B, Guidelines and Procedures for Maintenance of Airport Pavements. A PCI survey consists of dividing pavement into a series of sections, selecting random sections for sampling and inspecting a given portion of each sample section to determine overall pavement deterioration. Pavement deterioration is based on the quantification of the different types, the severity and the number of distresses present in the sample 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. It 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 figure below. Routine Maintenance consists of patching, crack sealing and joint sealing; Pavement Preservation includes surface treatments and thin overlays; Major Rehabilitation refers to full depth pavement reconstruction and thick overlays.

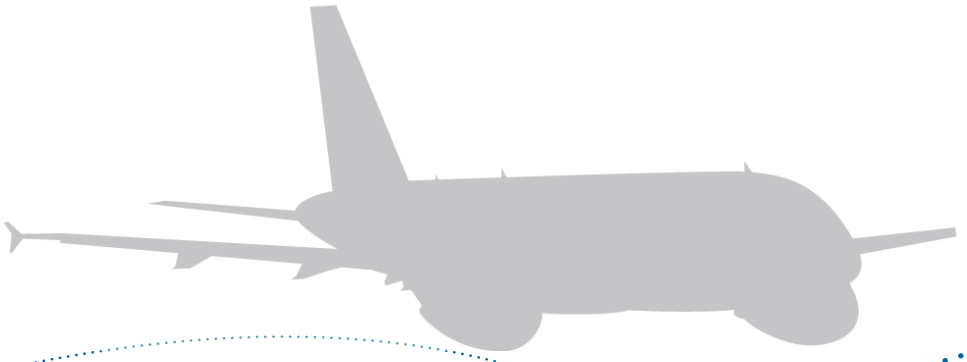


Pavement Classification Number (PCN)

Pavements at the commercial service airports, Fargo Airport, Bismarck Airport, Devils Lake Regional, Dickinson Airport, Grand Forks International, Jamestown Regional and Minot International Airport, were analyzed in this study to provide a PCN value as detailed in FAA Advisory Circular 150/5335-5B, Standardized Methods of Reporting Airport Pavement Strength – PCN. In addition to the airports listed above, Williston conducted their own PCN analysis and that value is included as part of this study. The PCN value will soon be mandated by the FAA at certain facilities. A Pavement Classification Number is a value that indicates the strength of a pavement as it relates to aircraft classification numbers, which are assigned to each type of aircraft. Aircraft traffic information as well as subgrade and pavement strengths are critical inputs in determining this value. Subgrade strength was determined using nondestructive testing in accordance with AC 150/5370-11B, Use of Nondestructive Testing in the Evaluation of Airport Pavements.

Typical Distress Types

On the following page is a brief description of the most commonly observed pavement distresses found at North Dakota airports. Airports in North Dakota have either one or a combination of Asphalt concrete (AC) pavement and Portland cement concrete pavement (PCC) with their being slightly more AC pavement than PCC pavement.



TYPICAL DISTRESS TYPES

LONGITUDINAL AND TRANSVERSE CRACKING

The predominant distress type found on asphalt pavements at North Dakota airports is longitudinal and transverse (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 a common distress type for PCC pavement. This distress is caused by a combination of load repetition, curling stresses, and shrinkage stresses.

BLOCK CRACKING

This distress generally appears over relatively large areas as a series of L&T cracks arranged in a pattern of square or rectangular blocks. It is cause by shrinkage of asphalt pavement over time and the repeated deformation caused by daily temperature cycles. It is not a load-related distress, and its occurrence usually indicates that the pavement has become significantly brittle (oxidized).

WEATHERING AND RAVELING

As asphalt pavement ages and becomes brittle, the asphalt binder and aggregate can begin to wear away. This process is called weathering and raveling. The wearing away of asphalt cement, or binder, is called weathering. Raveling occurs as the aggregate begins to dislodge and produce loose pieces of material, posing a safety hazard as it may be ingested, picked up and thrown by aircraft engines.

ALLIGATOR (FATIGUE) CRACKING

Alligator (fatigue) cracking is a load-related distress. Alligator cracking is 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.

DEPRESSION

Depressions are pavement surface areas having elevations slightly lower than those of the surrounding pavement. Depressions can be caused by settlement of the underlying base layers or soils. Depressions are often found in areas where insufficient drainage capacity exists and soils are weakened due to water penetration, or where underlying layers were not compacted enough during construction. Additionally, depressions can be built in during construction.

SPALLING

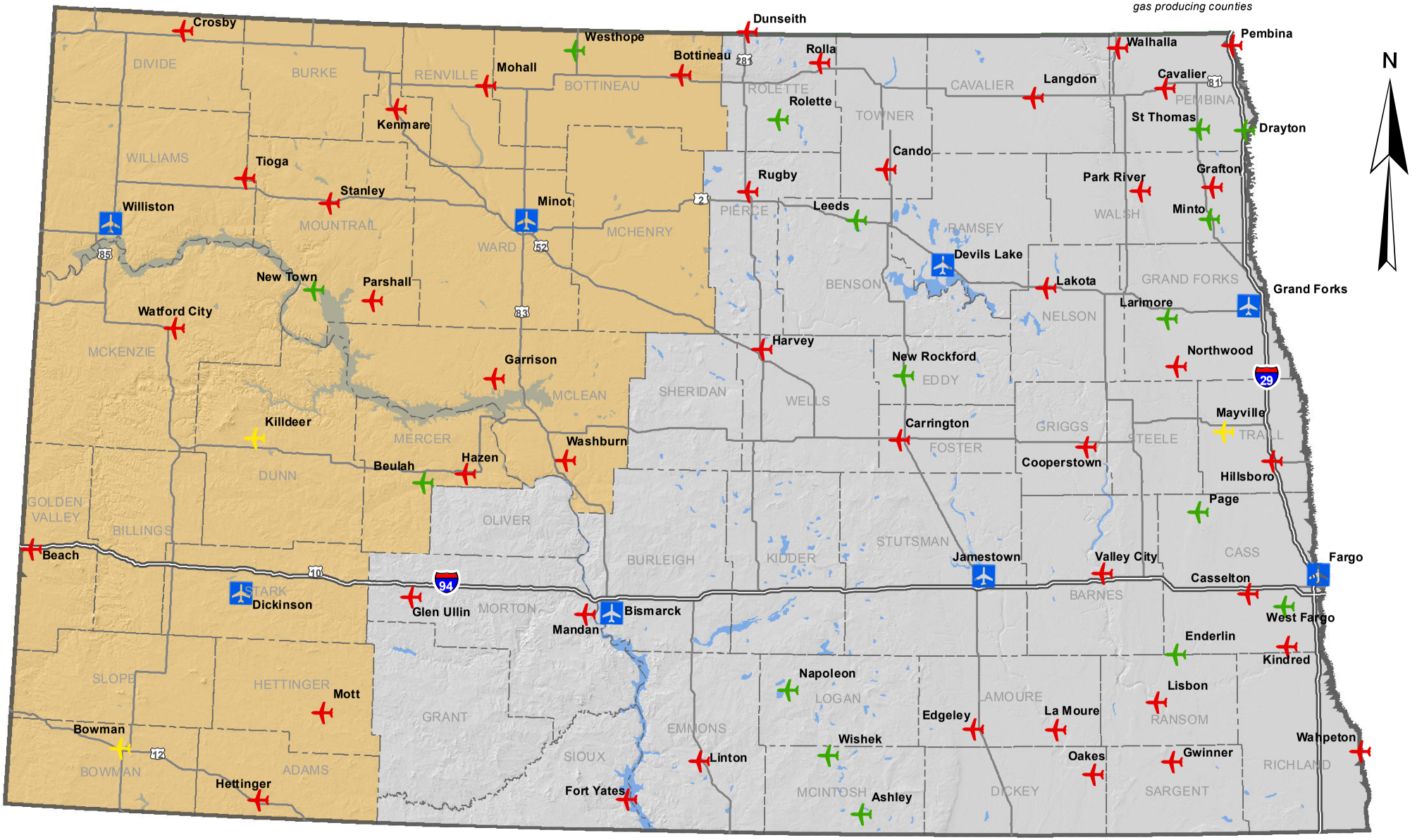
Spalling, in PCC pavement, is the breakdown of the slab edges in close proximity to the slab joint. Spalling is identified as occurring in the corner or along the joint of a PCC slab. Spalling is typically caused by the introduction of incompressible material in the joint, weaker pavement at the joint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

Project Airports

In 2012, a total of 67 airports were assessed for the current project. Of these, 51 were part of the National Plan of Integrated Airport Systems (NPIAS) and 16 were Non-NPIAS. NPIAS airports inspected included 8 commercial service airports and 43 general aviation airports. NPIAS airports qualify for federal funding. Non-NPIAS airports are not qualified for federal funding and must be funded solely by state and local contributions. Bowman, Killdeer and Mayville airports as well as portions of pavement at numerous other airports were excluded from this PCI evaluation due to near future scheduled reconstruction as well as any pavement recently reconstructed and deemed to be in excellent condition. A PCI of 100 was assumed for all newly constructed pavement or pavement programmed to be reconstructed in the next year. The figure on the following page identifies all of the airports in North Dakota that were included in the APMS update conducted in 2012.

67 AIRPORTS

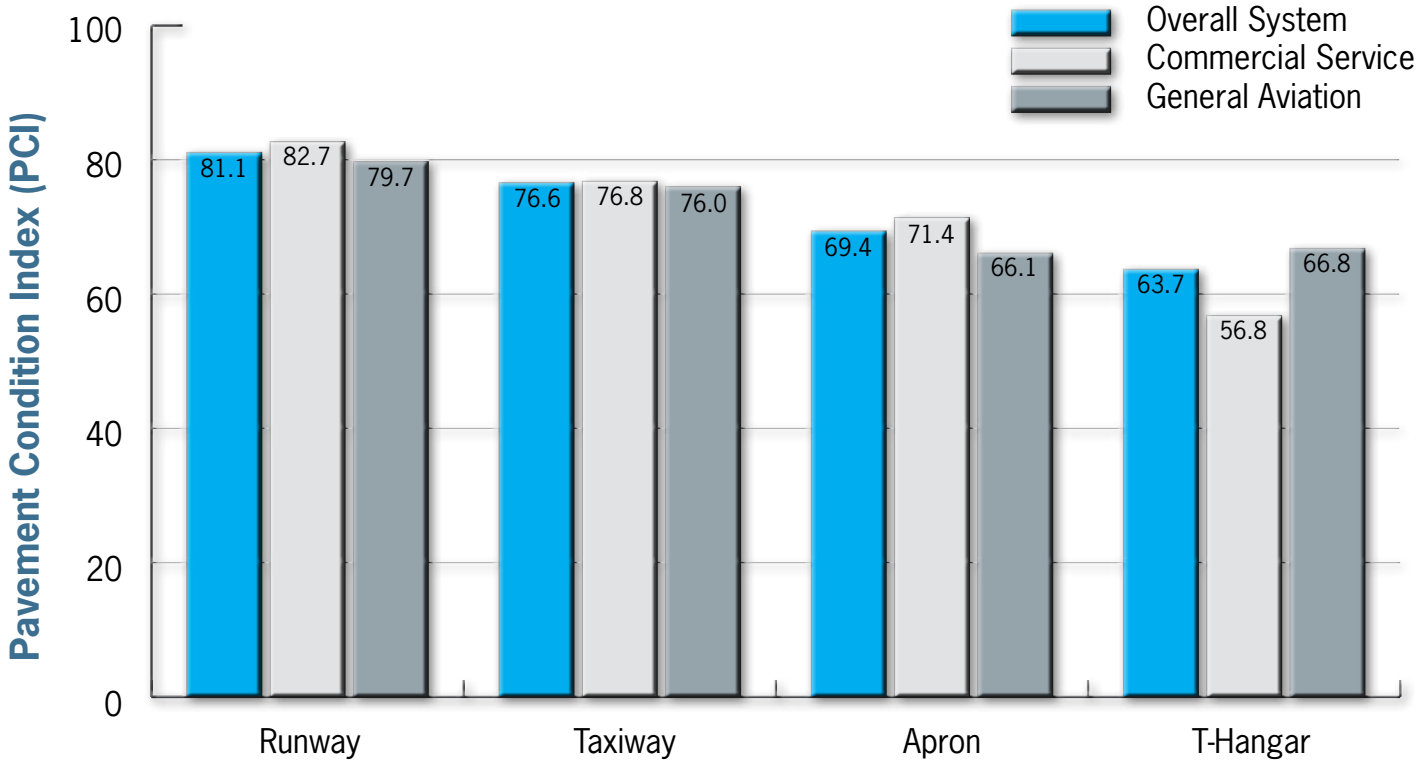
NORTH DAKOTA



OVERALL PAVEMENT CONDITION

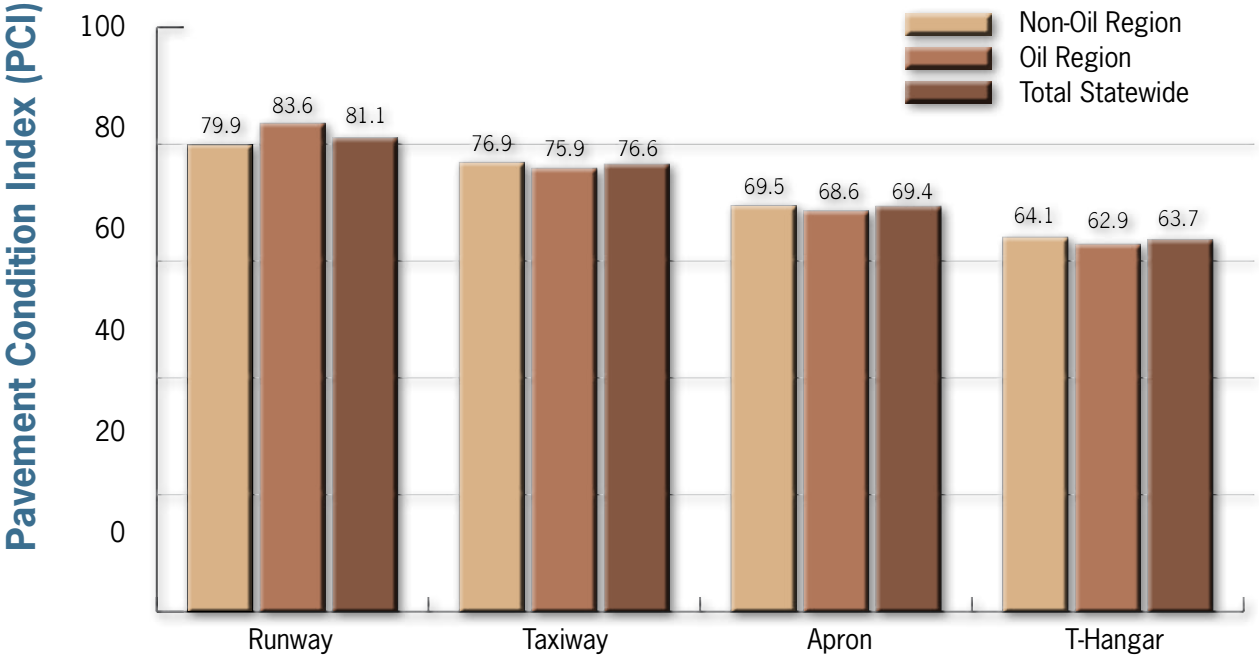
The overall 2012 area-weighted pavement condition of all airports included in the North Dakota APMS is a PCI of 77. The figure below shows the 2012 condition of all pavements broken out by pavement use (runway, taxiway, apron, T-Hangar) and divided further into airport classification (commercial and general aviation).

Statewide Pavement Condition Summary by Use



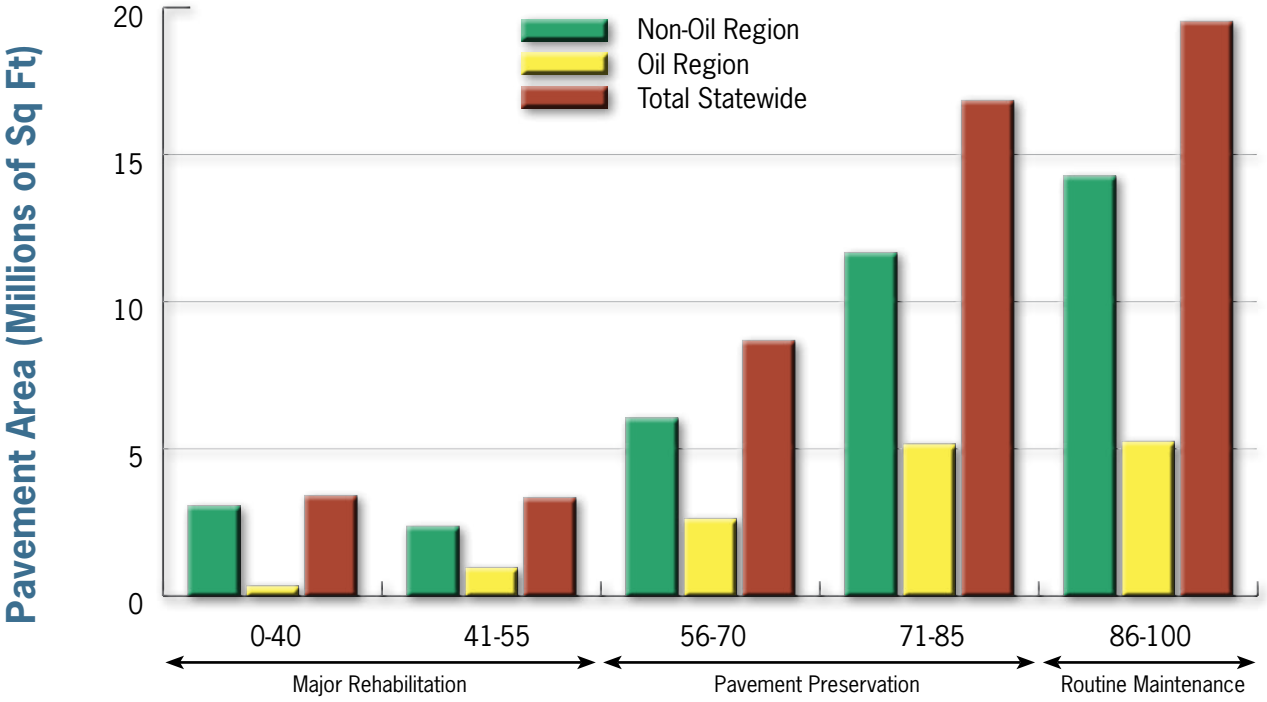
North Dakota aviation is experiencing serious impact by an oil boom which affects select airports in the western part of the state. Because of this, further analysis has been conducted to compare the oil producing regions of the state to the non-oil regions. Currently ND pavement area is divided at approximately 72% in the Non-oil region versus 28% in the oil region. The figure below depicts the breakout of pavement condition by use as well as the region of the state it is located in. By comparison, these two regions have a relatively close PCI value.

Pavement Condition Summary by Use



The following figure illustrates, at both the state level as well as oil region versus non-oil region, what types of repair should be performed in order to maintain the existing pavement condition.

Area Summary by PCI Range



PAVEMENT CONDITION RESULTS

Critical PCI Values

For each year of the analysis, the future conditions of the pavements were estimated and a determination was made as to whether preventative 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 preventative maintenance. Major rehabilitation/reconstruction was recommended for any PCI value below the PCI critical thresholds.

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

Pavement Condition History Forecast

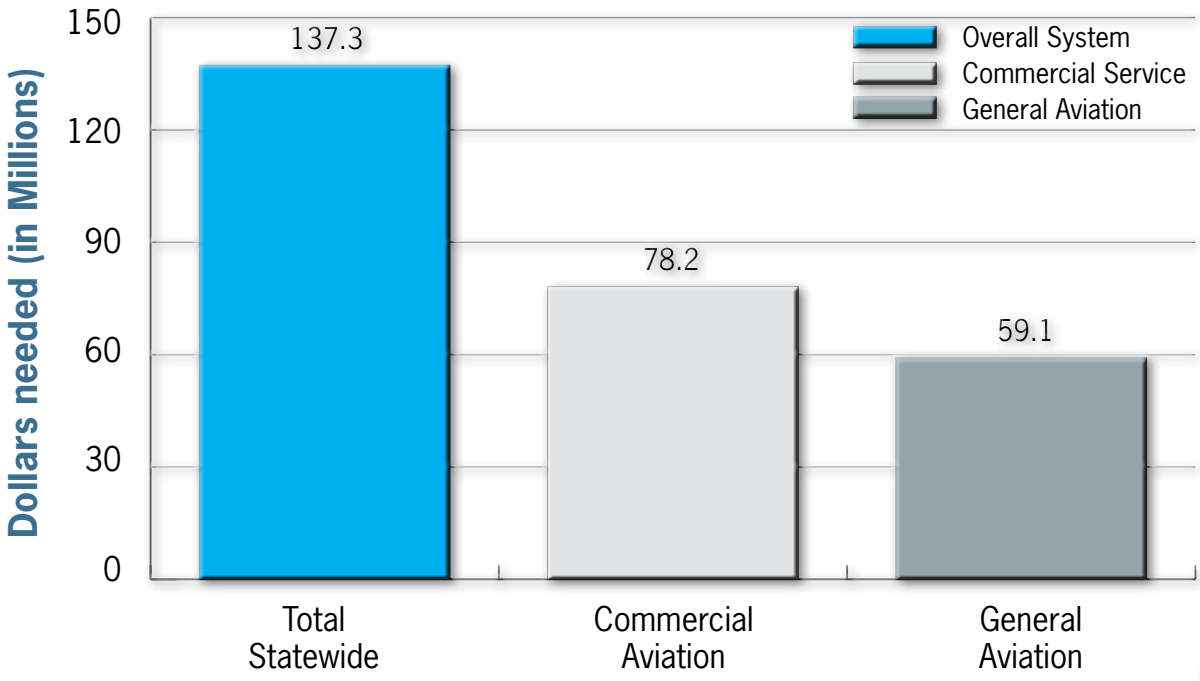
The table below details the area-weighted average pavement condition index for all airports included in this APMS update as well as record data from previous updates. The unlimited funding PCI value was determined under the assumption that all potential projects would be completed in the next 5 years. If no work is completed, the PCI value will slowly decline.

Branch Use	Area-weighted Average Condition (PCI)			
	2009	2012	Unlimited Funding 2017	Do Nothing 2017
Entire System	76	77	85	70
Runways	78	81	84	74
Taxiways	76	77	86	70
Aprons	72	69	85	61
T-Hangars	64	64	84	53

Pavement Funding Assessment

Funding for aviation projects within the state is crucial in order to maintain a steady pavement condition and ensure safety of all 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 result in a need for more major rehabilitation or reconstruction, which in turn significantly increases future cost. If all projects identified in the PCI study were funded, an approximate total of $137.3 million would be needed during the next 5 years – $78.2 million for commercial service airports and $59.1 million for general aviation airports as shown in the figure below. The individual funding needs through 2017 for each airport are summarized in the tables on the following pages. The analysis was run for 2013 through 2017 and an inflation factor of 4 percent was applied when calculating future cost of work. The unit costs used to estimate overall project costs were based on 2010 average unit costs of recent projects completed throughout the state. These costs are averages and are not intended to be used for specific project planning purposes.

5 Year Funding Needs



SUMMARY

In summary, a total of 67 airports were included in the current North Dakota APMS study and are represented on the state APMS database. This includes 8 NPIAS commercial airports, 43 NPIAS general aviation airports and 16 Non-NPIAS airports. The current weighted PCI value for the state of North Dakota is 77 in 2012. If no funding is provided, this PCI value will steadily fall to 70 by the end of 2017. If all work identified is completed, the 2017 overall PCI of the system is anticipated to increase to a value of 85. The current backlog of work for the next 5 years, on existing pavements, is approximately $137.3 million with approximately $78.2 million for commercial service airports and $59.1 million for general aviation airports.

5 YEAR PAVEMENT FUNDING THROUGH 2017

Classification	Airport Name	Inspection Year	5 Year Total Funding Needs
Commercial (NPIAS)	Bismarck Municipal	2012	$16,138,353.00
	Devils Lake Regional	2012	$4,868,498.00
	Dickinson Theodore Roosevelt Regional	2012	$1,355,851.00
	Hector International	2012	$17,396,119.00
	Grand Forks International	2012	$13,226,540.00
	Jamestown Regional	2012	$8,955,772.00
	Minot International	2012	$8,994,805.00
	Sloulin Field International	2012	$7,250,901.00
	Commercial Service Total (NPIAS):		**$78,186,839.00**
General Aviation (NPIAS)	Barnes County Municipal	2012	$1,493,961.00
	Beach	2012	$385,624.00
	Bottineau Municipal	2012	$186,628.00
	Cando Municipal	2012	$404,352.00
	Carrington Municipal	2012	$223,761.00
	Casselton Robert Miller Regional	2012	$4,632,952.00
	Cavalier Municipal	2012	$8,850.00
	Cooperstown Municipal	2012	$2,284,693.00
	Crosby Municipal	2012	$896,905.00
	Edgeley Municipal	2012	$1,924,493.00
	Garrison Municipal	2012	$2,067,624.00
	Glen Ullin Regional	2012	$3,158.00
	Grafton Hutson Field	2012	$806,204.00
	Gwinner-Roger Melroe Field	2012	$501,760.00
	Hamry Field	2012	$375,320.00
	Harry Stern	2012	$1,375,314.00
	Harvey Municipal	2012	$14,691.00
	Hettinger Municipal	2012	$2,105,128.00
	Hillsboro Municipal	2012	$2,394,691.00
	Int'l Peace Garden	2012	$62,751.00
	Kenmare Municipal	2012	$2,022,173.00
	La Moure Rott Municipal	2012	$1,760,506.00
	Lakota Municipal	2012	$186,588.00
	Linton Municipal	2012	$1,176,621.00
	Lisbon Municipal	2012	$1,304,185.00
	Mandan Municipal	2012	$1,468,816.00
	Mercer County Regional	2012	$364,060.00
	Mohall Municipal	2012	$235,585.00

Classification	Airport Name	Inspection Year	5 Year Total Funding Needs
General Aviation (NPIAS)	Mott Municipal	2012	$50.00
	Northwood Muni-Vince	2012	$1,602,896.00
	Oakes Municipal	2012	$945,840.00
	Park River - W.C. Skjerven	2012	$0.00
	Parshall-Hankins	2012	$1,606,392.00
	Pembina Municipal	2012	$762,635.00
	Robertson Field	2012	$3,004,956.00
	Rolla Municipal	2012	$2,984,746.00
	Rugby Municipal	2012	$1,024,122.00
	Standing Rock	2012	$54.00
	Stanley Municipal	2012	$870,763.00
	Tioga Municipal	2012	$1,770,861.00
	Walhalla Municipal	2012	$2,231,685.00
	Washburn Municipal	2012	$4,298.00
	Watford City Municipal	2012	$1,001,248.00
	General Aviation Service Total (NPIAS):		**$48,477,940.00**
General Aviation (Non-NPIAS)	Ashley Municipal	2012	$3,184,858.00
	Beulah Municipal	2012	$72,319.00
	Drayton Municipal	2012	$174,657.00
	Larimore Municipal	2012	$2,061,470.00
	Leeds Municipal	2012	$419,723.00
	Minto Municipal	2012	$169,021.00
	Napolean Municipal	2012	$710.00
	New Town Municipal	2012	$1,410,464.00
	Page Regional	2012	$614,901.00
	Rolette	2012	$1,340,969.00
	Sky Haven	2012	$149,284.00
	St. Thomas Municipal	2012	$392,724.00
	Tomlinson Field	2012	$534,170.00
	West Fargo Municipal	2012	$66,710.00
	Westhope Municipal	2012	$0.00
	Wishek Municipal	2012	$0.00
	General Aviation Service Total (Non-NPIAS):		**$10,591,980.00**
		Grand Total:	**$137,300,000**

FUNDING

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