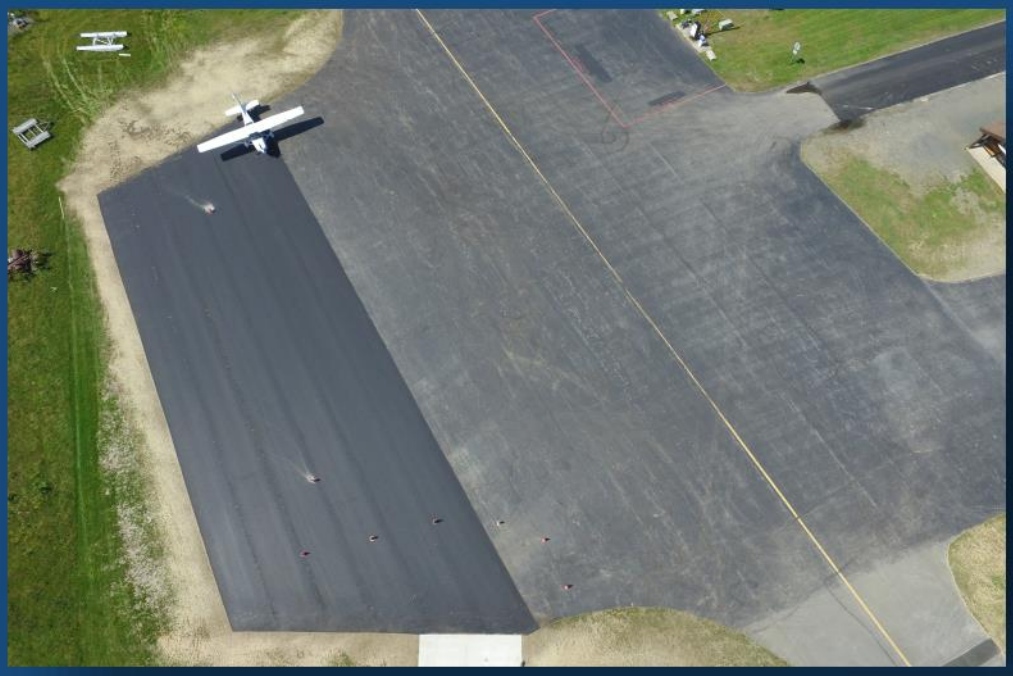
Maine Department of Transportation

2019 Executive Report

MaineDOT

Airport Pavement Management System



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Overview

Background:

The Maine airport system plays a vital role in supporting economic development opportunities statewide. The pavements at these airports represent the largest capital investment in the Maine airport system, and the condition of these pavements is important both from a cost-effective approach to maintaining them as well as providing safe facilities that continue to foster economic opportunity. Timely airport pavement maintenance and rehabilitation (M&R) are crucial because repairs become much more expensive once the conditions deteriorate below certain levels. Additionally, certain airport pavement distresses, such as wide cracking and loose debris, pose a significant safety risk to aircraft.

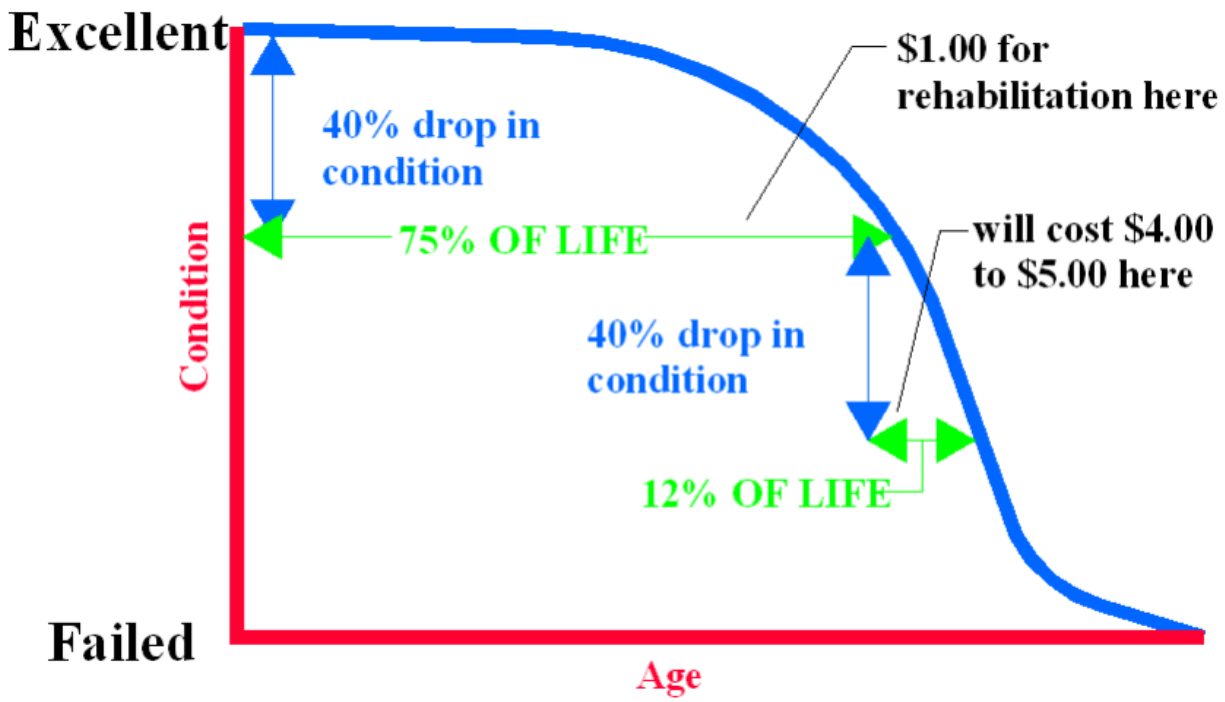
Recognizing a need to protect this critical investment, the MaineDOT maintains an airport pavement management system (APMS). The APMS provides subject airports, MaineDOT, and the Federal Aviation Administration (FAA) with objective data on airport pavement conditions and is used to proactively anticipate needs and plan for the capital investments required to preserve the system.

During this project, a pavement condition assessment was undertaken at twenty-eight Maine airports during the Fall of 2018. The collected pavement inventory and condition data were used to create the APMS database and analyzed to determine overall condition levels, identify pavement-related needs, and develop a 5-year M&R plan for the subject airports. The total cost of needs determined through this project reflect costs for pavement-related work itself and do not include any additional costs for items such as design, lighting, signage, construction monitoring, marking, or contingency fees. Actual final project costs may be substantially greater depending on these individual factors. This report describes the findings and recommendations of the APMS project.

Benefits of the Airport Pavement Management System:

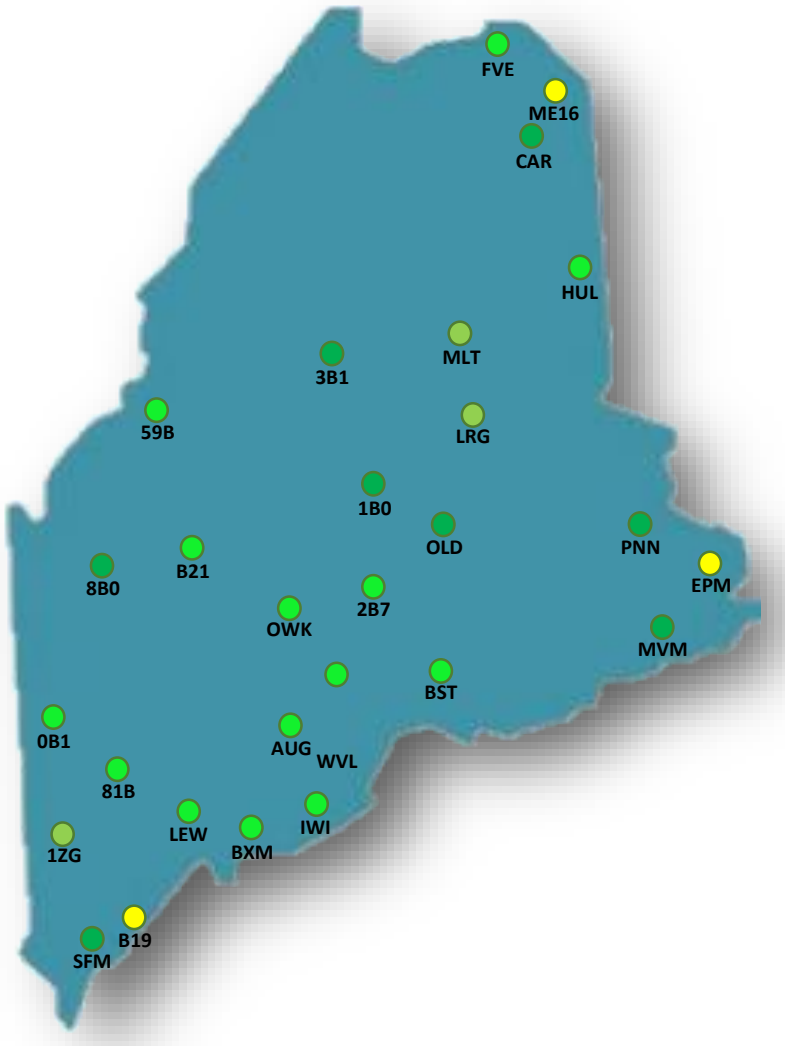
The MaineDOT APMS yields many benefits. It provides MaineDOT, the individual airports, and the FAA with the information needed to monitor the condition of the pavements to ensure they are able to safely accommodate aircraft operations. The APMS also provides MaineDOT with a tool that can be used to make cost-effective decisions about the M&R of the pavement infrastructure and to evaluate the long-term impacts of the decision-making. The APMS fulfills many of the National Plan of Integrated Airport Systems (NPIAS) requirements of Public Law 103-305 and Grant Assurance 11 for maintaining a pavement maintenance management system.

The APMS also identifies when different pavement strategies would be most appropriate. The timing of projects is important because preventive maintenance, such as crack sealing and surface treatments, can cost-effectively extend the life of a pavement. Once preventive maintenance is no longer the appropriate action, it is critical to perform major rehabilitation, such as an overlay or surface reconstruction, as soon as possible before the pavement structure becomes so deteriorated that the only viable alternative is complete reconstruction. The financial impact of delaying repairs until this point is reached can be severe, as reconstruction can cost many times the cost of less comprehensive rehabilitation, such as an overlay. In addition, there is a point when the pavement becomes unsafe for aircraft operations.



Project Airports

The twenty-seven NPIAS and one non-NPIAS (Loring International) airports represented in the figure below were evaluated during the MaineDOT APMS update.

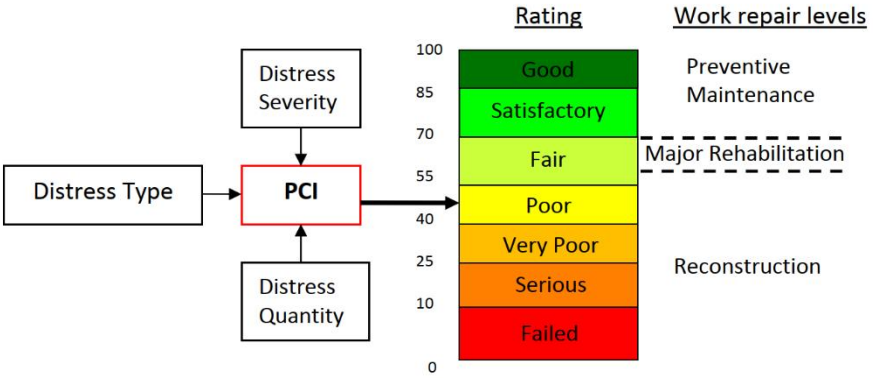


Airports in the MaineDOT APMS network

ID	Airport Name
LEW	Auburn/Lewiston Municipal
AUG	Augusta State
BST	Belfast Municipal
0B1	Bethel Regional
B19	Biddeford Municipal
BXM	Brunswick Executive
CAR	Caribou Municipal
OWK	Central Maine Airport of Norridgewock
OLD	Dewitt Field, Old Town Municipal
1B0	Dexter Regional
IZG	Eastern Slope Regional
EPM	Eastport Municipal
3B1	Greenville Municipal
HUL	Houlton International
LRG	Lincoln Regional
MVM	Machias Valley Municipal
MLT	Millinocket Municipal
59B	Newton Field, Jackman
FVE	Northern Aroostook Regional
81B	Oxford County Regional
2B7	Pittsfield Municipal
PNN	Princeton Municipal
SFM	Sanford Seacoast Regional
8B0	Stephen A. Bean Municipal
B21	Sugarloaf Regional, Carrabassett
WVL	Waterville Robert-LaFleur
IWI	Wiscasset
ME16	Loring International Airport

The pavement area evaluated at these airports is approximately 34 million square feet (50 percent runway, 19 percent taxiway or taxilane, and 31 percent apron).

Pavement Condition Assessment



PCI	TYPICAL PAVEMENT SURFACE
100	
60	
10	

The pavements were evaluated using the Pavement Condition Index (PCI) procedure, documented in FAA Advisory Circular (AC) 150/5380-6C, Guidelines and Procedures for Maintenance of Airport Pavements, FAA AC 150/5380-7B, Airport Pavement Management Program (PMP), and ASTM D5340-12, Standard Test Method for Airport Pavement Condition Index Surveys. This procedure is the standard used in the United States to visually assess and monitor the condition of airport pavements. Established in the early 1980's, it provides a consistent, objective, and repeatable method to evaluate overall pavement conditions. PCI data are also used to identify the most cost-effective repair type and timing of that repair.

During a PCI survey, a visual inspection of a pavement's surface is performed to quantify the types, severities, and amounts of pavement distress observed. This information is then used to develop a composite index that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed) to 100 (excellent). A statistical approach is then used to estimate the total quantity of distress and overall condition of the pavement section. The figure to the left is a visual representation of the PCI scale.

Typical Distress Types

Following is a description of the pavement distresses most commonly observed at the Maine airports included in this project. The description is limited to asphalt-surfaced pavements, because the majority of the airport infrastructure consists of this type of pavement.

Alligator Cracking

Alligator (or fatigue) cracks are a series of interconnected load-related cracks caused by the fatigue of the asphalt surface. Alligator cracking is a significant structural distress and develops only in places subject to traffic loads. These cracks typically initiate at the bottom of the asphalt layer and propagate upward.

Block Cracking

Block cracking is longitudinal and transverse cracking that has established a pattern of blocks ranging in size from 1ft x 1ft to 10ft x 10ft. This distress typically happens in older asphalt pavements and is an indication that the bituminous binder has lost most of its flexibility.

Longitudinal and Transverse Cracking

Longitudinal and transverse cracking are caused by pavement aging, by construction, and by subsurface movement. Aging occurs as pavement loses some of its components to the atmosphere and becomes more brittle. These cracks are not caused by wheel loads, although traffic may worsen their condition.

Patching

Patched areas are defined when a portion of the original pavement is replaced with a material intended as a semi-permanent repair. A patch is documented as a defect because it is considered to be a break in the integrity of the pavement structure. Patches are constructed for a variety of reasons including utility repairs, correcting grade issues, and addressing a defect in the original pavement.

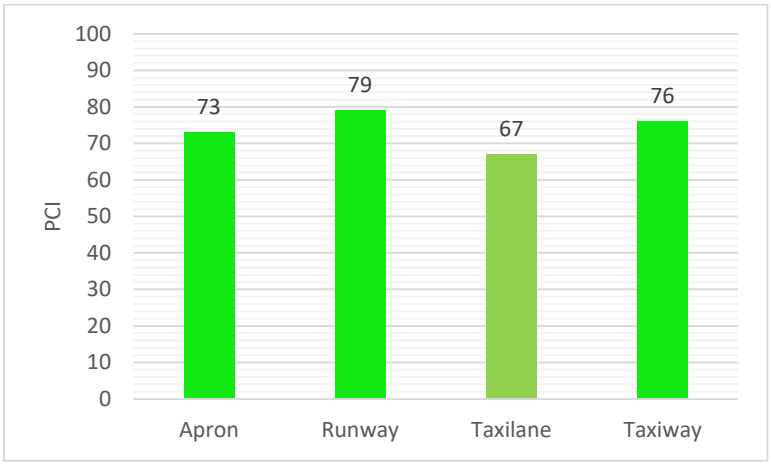
Raveling/Weathering

Raveling and weathering are the wearing away of the pavement surface. Raveling is the condition where the mid-to-large size aggregates are becoming dislodged; weathering is when the fine aggregate wears away and exposes the edges of the larger aggregate.

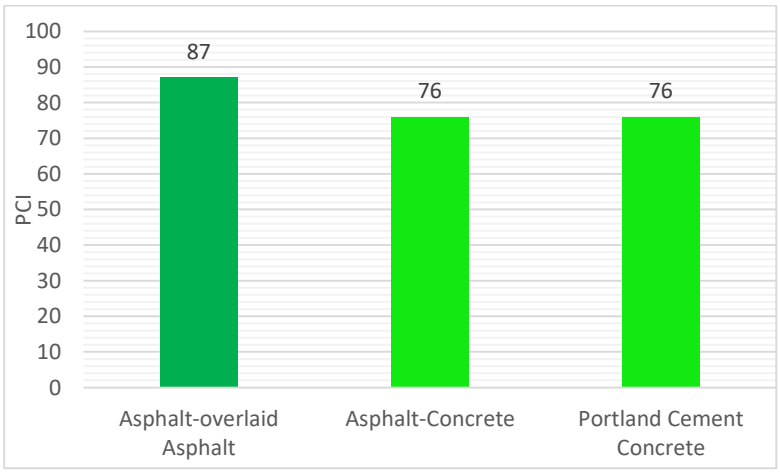
Pavement Condition Results

Overall Pavement Condition:

The overall area-weighted PCI (average PCI adjusted to account for the relative size of the pavement sections) of the twenty-eight airports was 77 at the end of 2019. The following figures show the 2018 area-weighted condition of the pavement broken out by pavement use and by pavement type.



PCI by Pavement Use

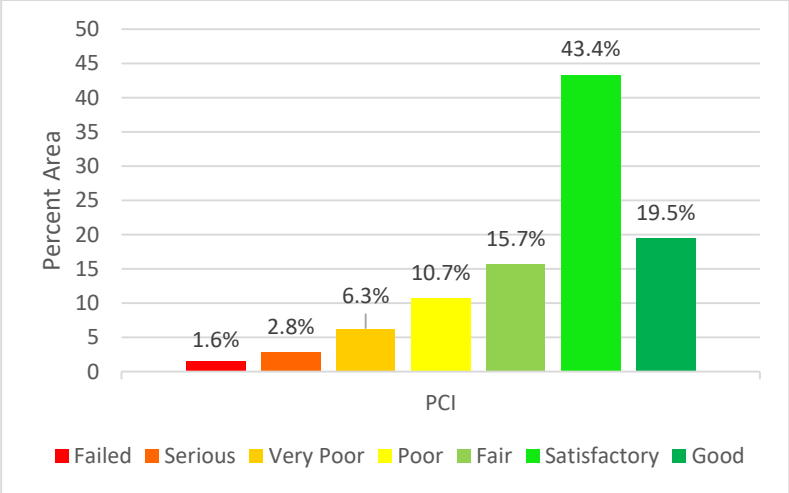


PCI by Pavement Type

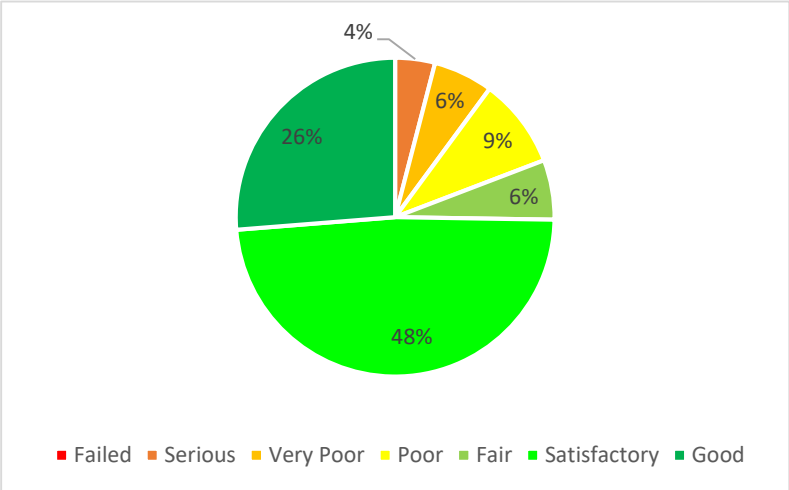
Pavement Needs Assessment

Approximately 63 percent of the pavement area at the project airports is at a condition level (at a PCI greater than 70) where timely preventive maintenance such as crack sealing and surface treatments will cost-effectively slow the rate of deterioration. Approximately 11 percent have fallen to a PCI (at 40 or lower) where reconstruction may be needed. The remaining 26 percent of the pavement infrastructure is estimated to need rehabilitation such as an overlay.

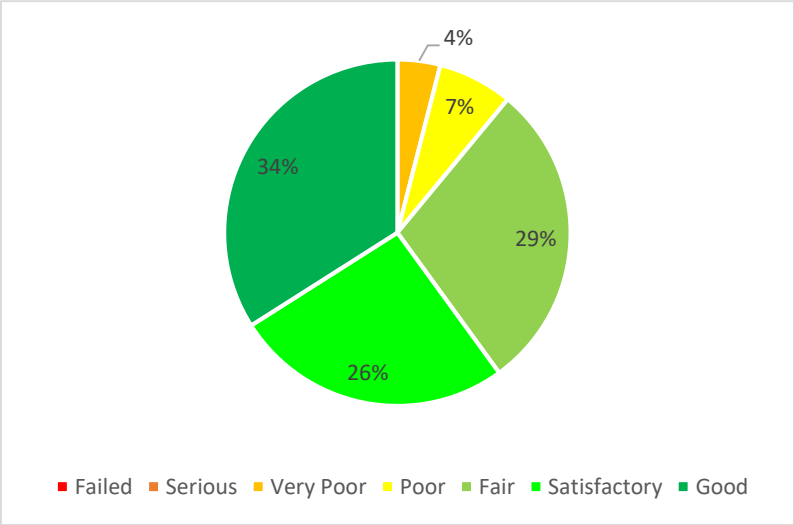
The following figures show the percentage of pavement broken down into each PCI category by color. The largest percentage of overall pavement area possibly needing reconstruction to restore operational condition are taxiways, and the smallest percentage of pavement area in possible need of reconstruction are runways.



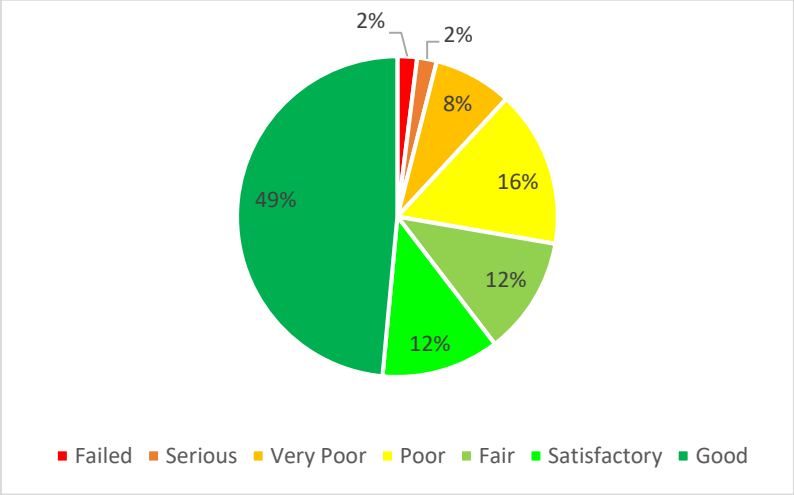
2018 Summary network condition distribution



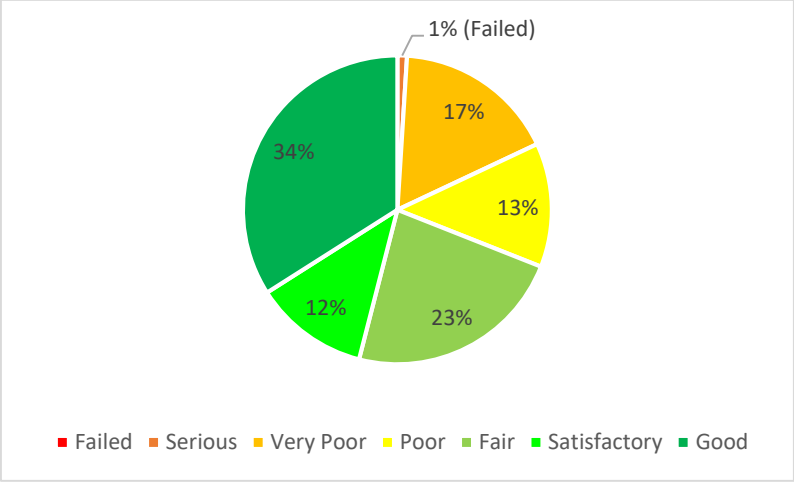
2018 Apron condition distribution



2018 Runway condition distribution



2018 Taxilane condition distribution



2018 Taxiway condition distribution

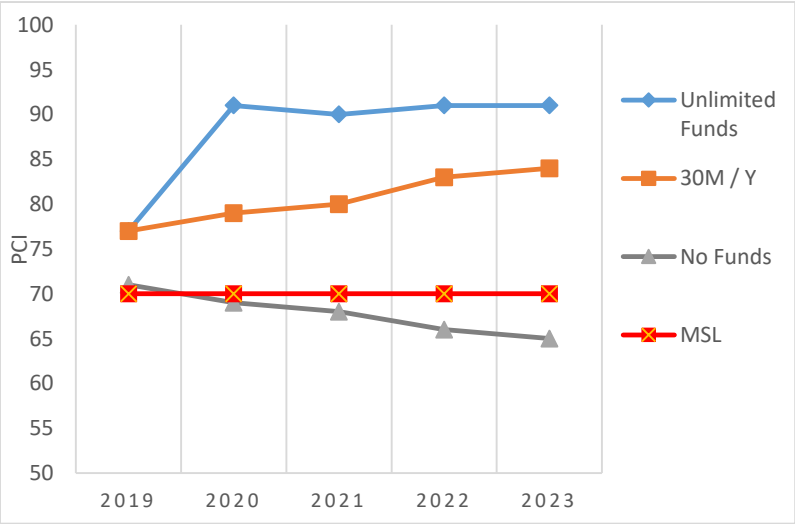
Addressing Pavement Needs

An analysis was performed to develop an approach for addressing pavement needs anticipated for the next 5 years (2019 to 2023). For each year of the analysis, the future conditions of the pavements were predicted and a determination was made as to whether preventive maintenance or major rehabilitation/reconstruction was the appropriate and most cost-effective strategy. The pavement was recommended for preventive maintenance if it was projected to be above a PCI of 70 for aprons, taxiways and taxilanes, and runways. Below these PCI thresholds, major rehabilitation/reconstruction was recommended, and the cost for each category of work was estimated.

Funding Levels:

To provide a baseline, if no funding is provided for major rehabilitation/reconstruction, pavement conditions will steadily decline at Maine airports, with a forecasted system-wide PCI of 64 by the end of 2023. This decrease would result in an increased need for major rehabilitation or reconstruction, which in turn would substantially increase the costs to keep the pavement system in a safe and serviceable condition.

In contrast, if all viable identified major rehabilitation and reconstruction projects were funded, approximately $234 million would be needed during the next 5 years - $48 million towards aprons, $59 million for taxiways, $7 million for taxilanes, and $119 million for runways. This amount only reflects costs for the pavement materials and does not include any other costs such as design, lighting, signage, construction monitoring, marking, or contingency fees. If all of the projects identified are completed at the time that they are recommended, a resulting system-wide PCI of 91 is forecasted at the end of 2023.



PCI Projections based on funding scenarios

Since the unlimited funding scenario is unrealistic from a budgetary standpoint, an additional analysis was investigated to determine the funding required to steadily increase the overall PCI in order to maintain status above MSL. It was determined that a funding level of approximately $30 million per year would allow the desired pavement condition goal of an area-weighted PCI of 83 to be achieved through 2023.

2019 – 2023 Unlimited Funding Needs

Preventive Maintenance		
Airport Name	**2019 Area-weighted PCI**	**5-year Total Funding Needs***
Biddeford Municipal	50	$3,672
Eastport Municipal	53	$5,238
Loring International	53	$444,456
Millinocket Municipal	58	$11,149
Lincoln Regional	62	$2,729
Belfast Municipal	69	$68,099
Eastern Slope Regional	70	$39,654
Oxford County Regional	73	$17,577
Bethel Regional	74	$12,824
Auburn-Lewiston Municipal	75	$34,698
Newton Field	76	$966
Augusta State	78	$12,538
Sugarloaf Regional	79	$8,387
Wiscasset Airport	79	$5,148
Waterville Robert-LaFleur	79	$22,892
Pittsfield Municipal	80	$13,836
Sanford Seacoast Regional	80	$52,416
Northern Aroostook Regional	82	$22,920
Central Maine Airport	82	$21,409
Brunswick Executive	83	$1,467,894
Houlton International	85	$38,399
Greenville Municipal	86	$56,749
Dexter Regional	91	$8,210
Stephen A. Bean Municipal	92	$4,763
Caribou Municipal	93	$8,257
Old Town Municipal	93	$8,087
Machias Valley Municipal	96	$3,706
Princeton Municipal	98	$7,227

* - values taken from individual Maine airport pavement reports, updated by ARA for 2020

Major Maintenance and Restoration		
Airport Name	**2019 Area-weighted PCI**	**5-year Total Funding Needs***
Biddeford Municipal	50	$7,242,359
Eastport Municipal	53	$7,328,297
Loring International	53	$126,275,137
Millinocket Municipal	58	$15,460,466
Lincoln Regional	62	$1,831,832
Belfast Municipal	69	$4,375,099
Eastern Slope Regional	70	$4,941,958
Oxford County Regional	73	$4,545,042
Bethel Regional	74	$1,109,458
Auburn-Lewiston Municipal	75	$6,075,976
Newton Field	76	$1,231,286
Augusta State	78	$8,872,846
Sugarloaf Regional	79	$577,348
Wiscasset Airport	79	$1,238,843
Waterville Robert-LaFleur	79	$8,535,952
Pittsfield Municipal	80	$1,261,806
Sanford Seacoast Regional	80	$10,897,944
Northern Aroostook Regional	82	$243,369
Central Maine Airport	82	$1,565,978
Brunswick Executive	83	$9,719,181
Houlton International	85	$6,134,018
Greenville Municipal	86	$507,886
Dexter Regional	91	$215,216
Stephen A. Bean Municipal	92	$226,951
Caribou Municipal	93	$967,124
Old Town Municipal	93	$1,346,377
Machias Valley Municipal	96	$96,523
Princeton Municipal	98	$31,074

* - values taken from individual Maine airport pavement reports, updated by ARA for 2020

The following tables provide further unlimited funding needs breakdowns for each pavement use category: aprons, runways, taxilanes, and taxiways.

Major Maintenance and Restoration - Aprons		
Airport Name	**2019 Area-weighted PCI**	**5-year Total Funding Needs***
Biddeford Municipal	41	$2,218,462
Augusta State	49	$6,683,945
Eastport Municipal	53	$111,922
Oxford County Regional	55	$4,545,042
Loring International Airport	55	$14,708,148
Lincoln Regional	56	$729,288
Caribou Municipal	59	$876,165
Belfast Municipal	65	$2,278,641
Northern Aroostook Regional	66	$243,369
Stephen A. Bean Municipal	66	$780,005
Wiscasset	66	$482,750
Sanford Seacoast Regional	67	$4,475,683
Millinocket Municipal	68	$1,032,222
Newton Field, Jackman	71	$729,288
Central Maine Airport	72	$249,694
Eastern Slopes Regional	75	$1,839,029
Machias Valley	77	$96,523
Bethel Regional	79	$149,046
Waterville Robert LaFleur	79	$1,289,258
Greenville Municipal	81	$432,263
Auburn/Lewiston Municipal	83	$740,154
Houlton International	84	$2,656
Brunswick Executive	85	$3,823,546
Princeton Municipal	85	$0
Sugarloaf Regional, Carrabassett	87	$0
Pittsfield Municipal	95	$0
Dewitt Field, Old Town Municipal	97	$0
Dexter Regional	100	$0

* - values taken from individual Maine airport pavement reports, updated by ARA for 2020

Major Maintenance and Restoration - Runways		
Airport Name	**2019 Area-weighted PCI**	**5-year Total Funding Needs***
Eastport Municipal	48	$6,123,975
Biddeford Municipal	54	$4,605,221
Millinocket Municipal	56	$14,616,940
Loring International Airport	57	$80,417,003
Lincoln Regional	66	$581,335
Auburn/Lewiston Municipal	68	$1,951,350
Bethel Regional	71	$787,305
Belfast Municipal	75	$1,096,947
Pittsfield Municipal	76	$1,100,660
Sugarloaf Regional, Carrabassett	76	$577,348
Brunswick Executive	77	$3,849,903
Wiscasset	77	$700,407
Newton Field, Jackman	78	$478,075
Eastern Slopes Regional	79	$0
Greenville Municipal	81	$0
Central Maine Airport	83	$695,732
Northern Aroostook Regional	85	$0
Sanford Seacoast Regional	86	$1,208,869
Oxford County Regional	88	$0
Augusta State	89	$454,838
Dexter Regional	91	$0
Houlton International	94	$0
Waterville Robert LaFleur	95	$0
Caribou Municipal	98	$0
Dewitt Field, Old Town Municipal	99	$0
Machias Valley	100	$0
Princeton Municipal	100	$0
Stephen A. Bean Municipal	100	$0

* - values taken from individual Maine airport pavement reports, updated by ARA for 2020

Major Maintenance and Restoration - Taxilanes		
Airport Name	**2019 Area-weighted PCI**	**5-year Total Funding Needs***
Lincoln Regional	22	$270,296
Central Maine Airport	33	$437,132
Eastport Municipal	36	$501,831
Eastern Slopes Regional	46	$1,158,700
Auburn/Lewiston Municipal	51	$3,323,273
Biddeford Municipal	54	$330,959
Bethel Regional	73	$68,336
Caribou Municipal	83	$74,459
Dexter Regional	84	$215,216
Pittsfield Municipal	86	$0
Greenville Municipal	89	$75,623
Sanford Seacoast Regional	90	$427,373
Waterville Robert LaFleur	90	$151,977
Dewitt Field, Old Town Municipal	94	$0
Wiscasset	94	$0
Belfast Municipal	100	$0
Princeton Municipal	100	$0
Augusta State	-	No taxilane
Brunswick Executive	-	No taxilane
Houlton International	-	No taxilane
Machias Valley	-	No taxilane
Millinocket Municipal	-	No taxilane
Newton Field, Jackman	-	No taxilane
Northern Aroostook Regional	-	No taxilane
Oxford County Regional	-	No taxilane
Stephen A. Bean Municipal	-	No taxilane
Sugarloaf Regional, Carrabassett	-	No taxilane
Loring International Airport	-	No taxilane

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Major Maintenance and Restoration - Taxiways		
Airport Name	**2019 Area-weighted PCI**	**5-year Total Funding Needs***
Loring International Airport	40	$31,149,896
Lincoln Regional	44	$250,916
Waterville Robert LaFleur	53	$6,983,539
Dewitt Field, Old Town Municipal	55	$1,346,377
Biddeford Municipal	56	$87,718
Eastern Slopes Regional	57	$1,944,229
Eastport Municipal	65	$590,570
Newton Field, Jackman	65	$23,924
Millinocket Municipal	68	$527,331
Houlton International	73	$6,134,017
Pittsfield Municipal	73	$161,146
Bethel Regional	74	$104,772
Belfast Municipal	75	$582,338
Brunswick Executive	76	$1,964,752
Sanford Seacoast Regional	78	$4,785,929
Sugarloaf Regional, Carrabassett	82	$0
Augusta State	83	$1,734,063
Stephen A. Bean Municipal	85	$10,780
Caribou Municipal	87	$16,500
Central Maine Airport	89	$183,420
Dexter Regional	89	$0
Northern Aroostook Regional	89	$0
Wiscasset	90	$55,686
Oxford County Regional	91	$0
Auburn/Lewiston Municipal	97	$61,199
Greenville Municipal	97	$0
Princeton Municipal	97	$31,074
Machias Valley	100	$0

* - values taken from individual Maine airport pavement reports, updated by ARA for 2020

Summary

- Twenty-eight airports are included in the MaineDOT APMS twenty-seven NPIAS airports and one non-NPIAS airport (Loring International).
- The total area of pavement included in the MaineDOT APMS database is 34 million square feet. This can be further broken down into 10.1 million square feet of apron pavement, 16.8 million square feet of runway pavement, 1 million square feet of taxilane pavement, and 5.6 million square feet of taxiway pavement.
- The overall pavement system has an area-weighted PCI of 77. Approximately 63 percent of the pavement area is at a condition level where preventive maintenance, such as crack sealing, is a cost-effective approach to maintaining the pavement. However, 37 percent of the pavement area has deteriorated to the condition where major rehabilitation or reconstruction is needed.
- If no funding for pavement major rehabilitation or reconstruction is provided, the overall area-weighted PCI of the system will deteriorate to an estimated 64 and accrue a funding backlog of $234 million for major rehabilitation and reconstruction by 2023.
- If all the projects identified as needing pavement major rehabilitation or reconstruction are funded, approximately $234 million will be needed over the next 6 years: $48 million for aprons, $59 million for taxiways, $7 million for taxilanes, and $119 million for runways. Approximately $108 million is needed for NPIAS airport pavement work and $126 million for non-NPIAS airport pavement work.
- To achieve the desired pavement condition goal of an area-weighted PCI of 83 for the entire system by 2023, approximately $30 million of annual funding is needed over the next 5 years.