massDOT
Massachusetts Department of Transportation
Aeronautics Division



Massachusetts Airport Pavement Management Program

2022 EXECUTIVE SUMMARY

PREPARED FOR

Massachusetts Department of Transportation Aeronautics Division
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OVERVIEW



Overview

BACKGROUND

The Massachusetts airport system plays a vital role in supporting economic development opportunities statewide. Pavements represent the largest capital investment in the Massachusetts airport system. Therefore, it is important to take a cost-effective approach to maintaining safe surfaces so that facilities continue to foster economic opportunity and growth. Timely airport pavement maintenance and rehabilitation (M&R) are crucial because repairs become much more expensive once the conditions deteriorate below certain levels. Additionally, some airport pavement distresses, such as wide cracking and loose debris, pose a significant safety risk to aircraft and the traveling public.

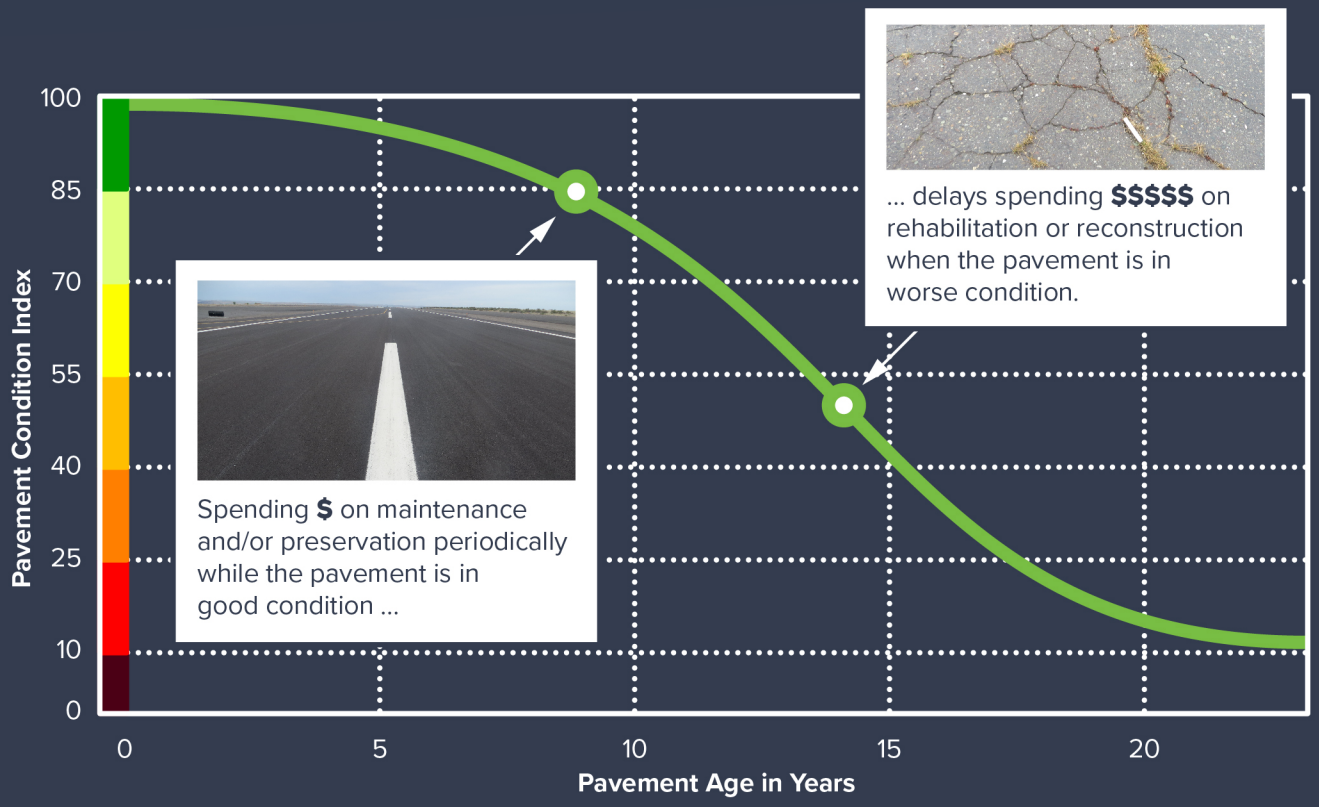
Recognizing a need to protect this critical investment, the Massachusetts Department of Transportation Aeronautics Division (MassDOT Aeronautics Division) maintains an airport pavement management program (PMP). The PMP provides all public-use airports in the Commonwealth, the Aeronautics Division, and Federal Aviation Administration (FAA) with objective data on airport pavement conditions. PMP analysis is used to proactively anticipate needs and plan for the capital investments required to preserve the system.

A pavement condition assessment was undertaken at thirty-two Massachusetts airports in 2021. The collected pavement inventory and condition data were used to update the PMP database and were analyzed to determine overall condition levels, identify pavement-related needs, and develop a 6-year M&R plan for the subject airports. The total cost of needs determined through this project reflects costs for pavement-related work itself and does not include any additional ancillary costs for items such as environmental studies, permitting, design, lighting, signage, drainage, 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 PMP project.

BENEFITS OF THE AIRPORT PAVEMENT MANAGEMENT SYSTEM

The MassDOT Aeronautics Division PMP yields many benefits. It provides the MassDOT Aeronautics Division, individual airports, and FAA with the information needed to monitor the condition of the pavements to ensure they can safely accommodate aircraft operations. The PMP also provides the Aeronautics Division 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 PMP fulfills many of the National Plan of Integrated Airport Systems (NPIAS) requirements of Public Law 103-305 and FAA Grant Assurance 11 for maintaining a pavement maintenance management system.

The PMP 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. Corrective actions should be taken as soon as possible before the pavement structure becomes so degraded 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. The figure below illustrates this concept.





Project Airports

Thirty-two airports were evaluated during the MassDOT Aeronautics Division PMP update, shown in the figure above.

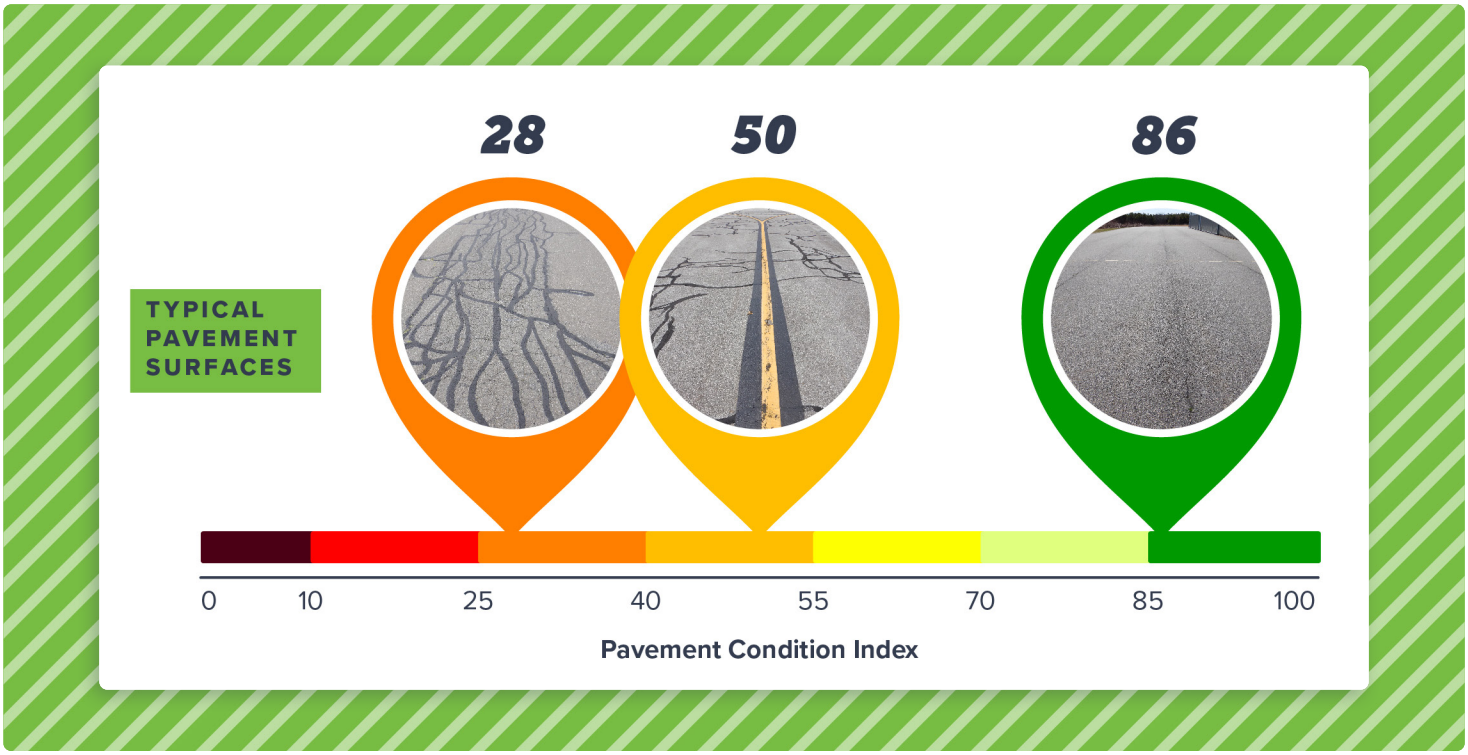
The pavement area evaluated at these airports is approximately 42.3 million square feet (39 percent runway, 26 percent taxiway, 26 percent apron/helipad, and 9 percent taxilane). The breakout of pavement area by airport role, as defined in the Massachusetts Statewide Airport System Plan (MSASP), is 36 percent commercial/scheduled service airports, 48 percent corporate/business airports, 13 percent community/business airports, and 3 percent essential/business airports. In addition to these breakdowns, approximately 97 percent of the pavement included, consisting of 40.9 million square feet, is located on NPIAS airports and 3 percent, or 1.4 million square feet, on non-NPIAS airports. Only NPIAS airports are eligible to receive funding assistance from the FAA.

Pavement Condition Assessment

PAVEMENT CONDITION INDEX

The pavements were evaluated using the Pavement Condition Index (PCI) procedure, documented in FAA Advisory Circular 150/5380-6C, *Guidelines and Procedures for Maintenance of Airport Pavements*, FAA Advisory Circular 150/5380-7B, *Airport Pavement Management Program (PMP)*, and ASTM D5340-20, *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 1980s, 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.

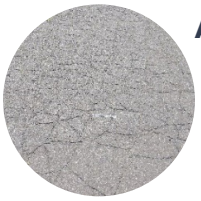
During a PCI survey, a visual inspection of a pavement's surface is performed to quantify the types, severities, and amounts of pavement distress observed. This information is used to develop a composite index that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed)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



Typical Distress Types

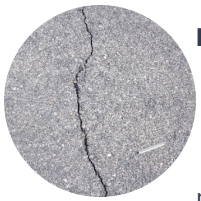
Following is a description of the pavement distresses most commonly observed at the Massachusetts airports included in this project. The description is limited to asphalt-surfaced pavements because most of the airport infrastructure consists of this type of pavement (over 96 percent).

ALLIGATOR CRACKING



Alligator cracking is a load-related distress caused by excessive tensile strains at the bottom of the asphalt layer or stabilized asphalt base layer from repeated aircraft loadings. It 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.

L&T CRACKING



Longitudinal & Transverse (L&T) cracking can be caused by any of the following: 1) separation of pavement at paving lane joints, 2) shrinkage of asphalt pavement due to temperature differentials in older or brittle pavements, or 3) reflection cracking from underlying existing cracking in overlaid pavements.

WEATHERING



Weathering is the loss of the asphalt binder and fine aggregate. 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



Raveling occurs as the coarse aggregate on an asphalt surface becomes dislodged and produces loose pieces called foreign object debris (FOD). FOD poses a safety hazard as it may cause serious damage to aircraft engines and equipment.

PATCHING & UTILITY CUT PATCH



Patching & Utility Cut Patch is a localized repair often used to address distresses such as wide cracks. Patching is also used to repair areas after the installation of underground utilities and is considered a defect no matter how well it is performing.

DEPRESSION

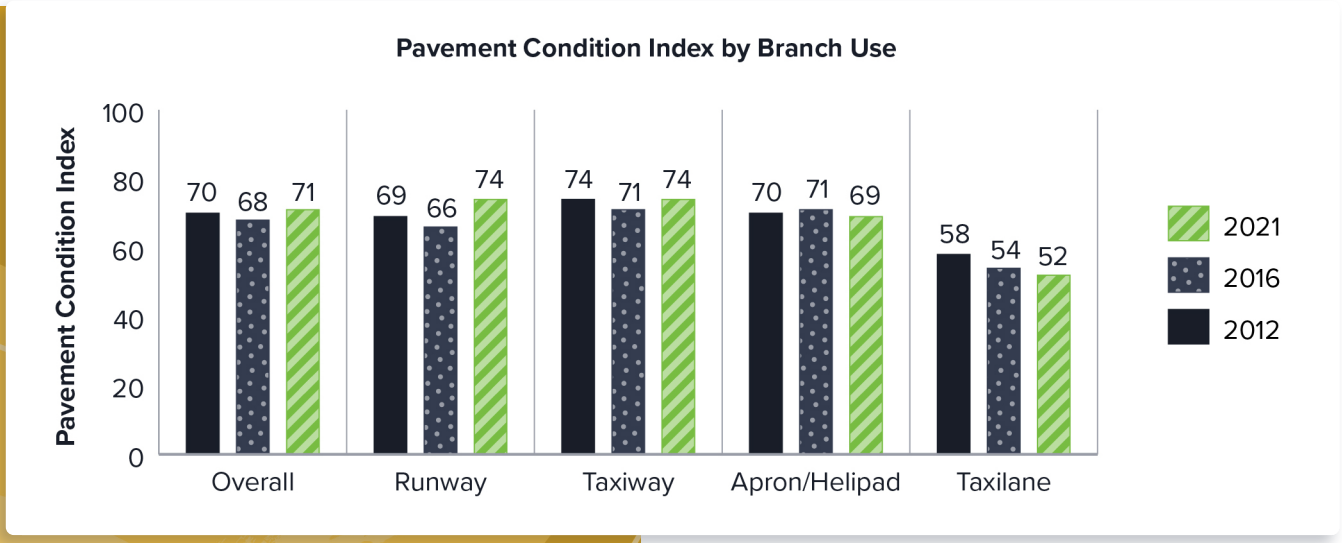


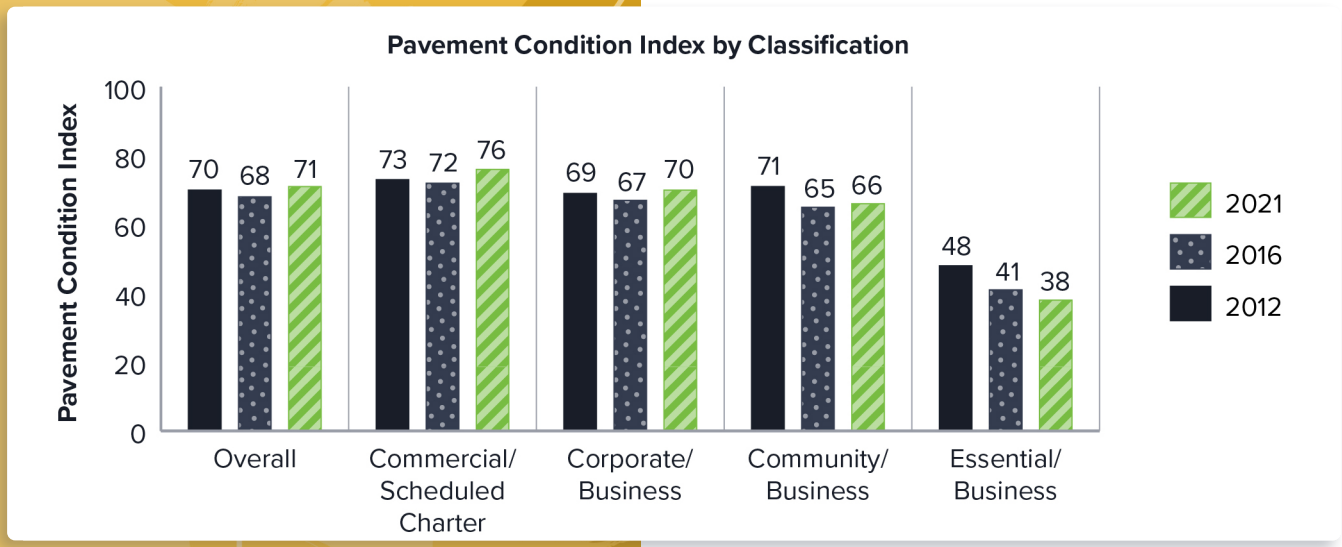
A **depression** is a localized area at a lower elevation than the surrounding pavement. This distress can be caused by the settlement of the foundation soil, or it can be “built up” during construction.

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 runways, taxiways, aprons/helipads, and taxilanes at thirty-two airports was 71 at the time of last inspection in 2021. This is compared to an area-weighted PCI of 72 for the twenty-two public airports, and 49 for the ten private airports included in the system. This can be compared to the 2016 PCI of 68. The following figures show the 2012, 2016, and 2021 area-weighted condition of the pavement broken out by pavement use and by airport classification.

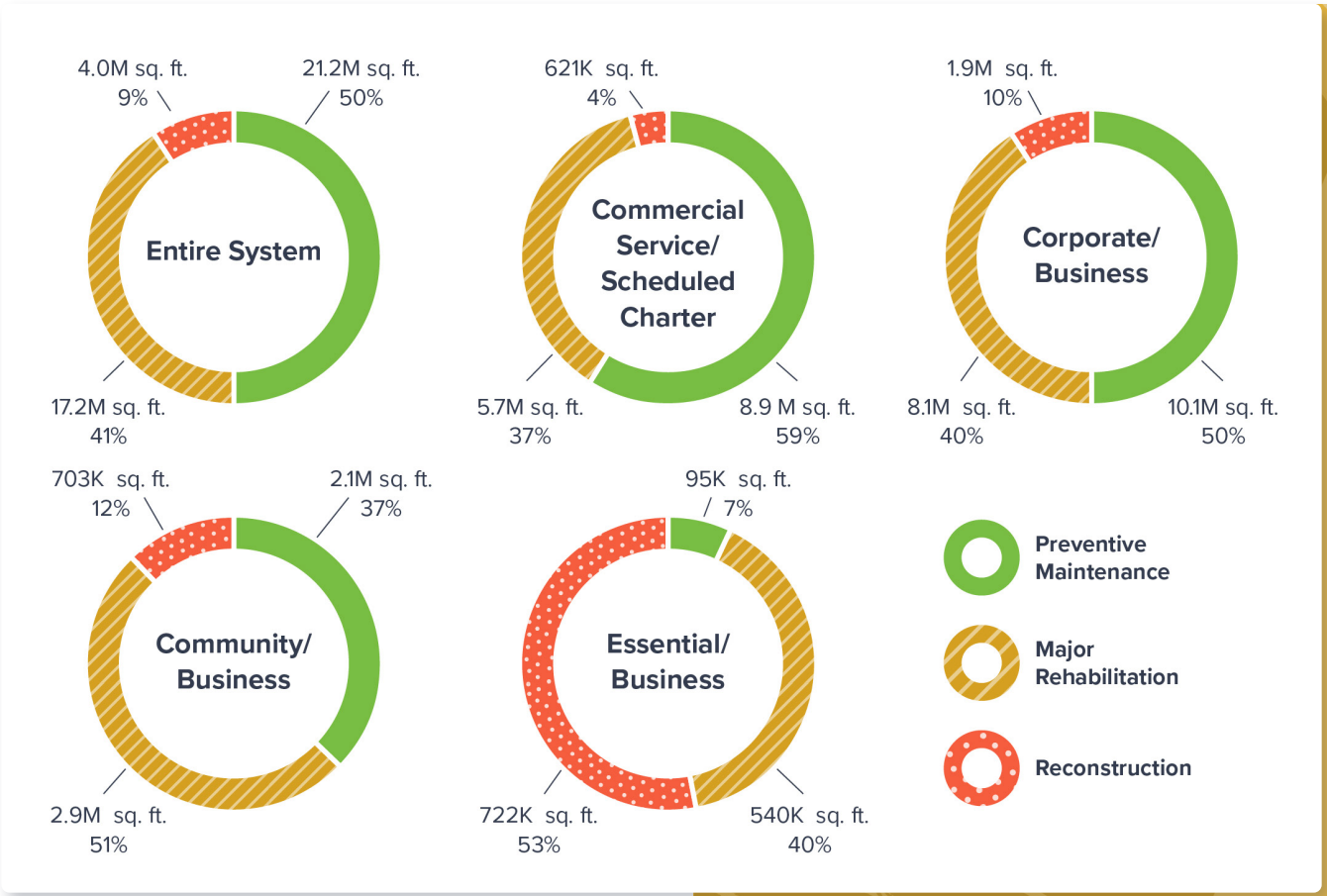




Pavement Needs Assessment

Approximately 50 percent of the pavement area at the project airports is at a condition level (assumed to be a PCI of 70 or greater) where timely preventive maintenance such as crack sealing and surface treatments will cost-effectively slow the rate of deterioration, and approximately 9 percent has fallen to a PCI (assumed to be below 40), where reconstruction may be needed. The remaining 41 percent of the pavement infrastructure is estimated to need rehabilitation such as an overlay.

The following figures show the percentage of pavement estimated to require each level of repair (preventive maintenance, major rehabilitation, and reconstruction). The largest percentage of overall pavement area possibly needing reconstruction to restore operational condition is at the essential/business airports and the smallest percentage of pavement area in possible need of reconstruction is at the commercial service/scheduled charter airports.



Addressing Pavement Needs

An analysis was performed to develop the best approach for addressing pavement needs anticipated for the next 6 fiscal years (FY2022 to FY2027). The future conditions of the pavements were predicted for each fiscal year. A determination was then 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 at or above a PCI of 70. Below this PCI threshold, major rehabilitation/ reconstruction was recommended, and the cost for the major rehabilitation/reconstruction work was then estimated.

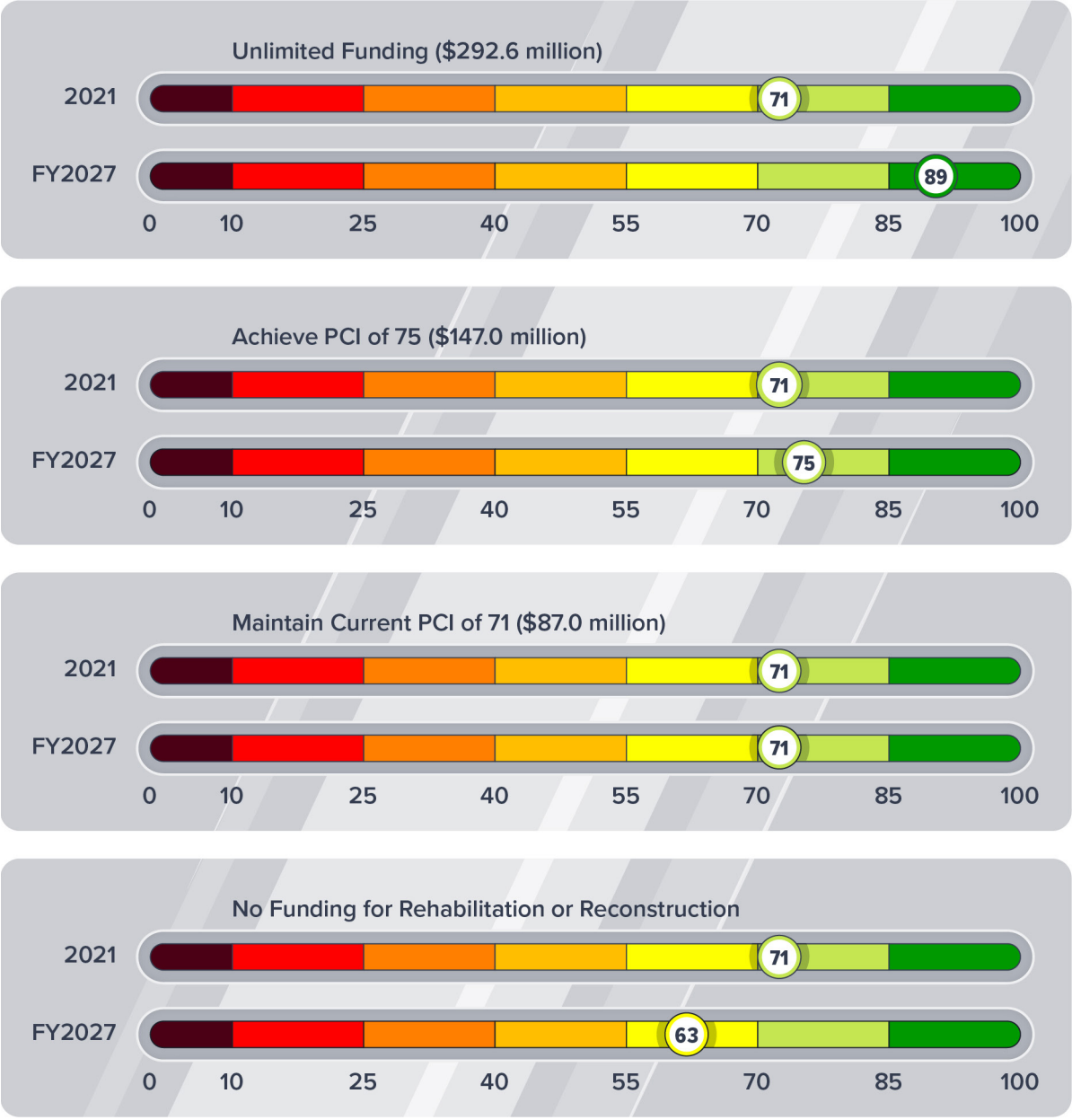
FUNDING LEVELS

To provide a baseline, if no funding is provided for major rehabilitation/reconstruction, pavement conditions will steadily decline at Massachusetts airports, with a forecasted system-wide PCI of 63 by the end of FY2027. 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 projects were funded, approximately $292.6 million would be needed during the next 6 fiscal years—$94.4 million for commercial service/scheduled charter airports, $152.0 million for corporate/ business airports, $31.4 million for community/ business airports, and $14.8 million for essential/ business airports. Of this amount, approximately $276.7 million is needed for NPIAS airport pavement work and $15.9 million for non-NPIAS airport pavements. The total cost of needs determined through this project reflects costs for pavement-related work itself and does not include any additional ancillary costs for items such as environmental studies, permitting, design, lighting, signage, drainage, construction monitoring, marking, or contingency fees. If all the projects identified are completed at the time that they are recommended, a resulting system-wide PCI of 89 is forecasted at the end of FY2027.

Since the unlimited funding scenario is unrealistic from a budgetary standpoint, two additional analyses were investigated to determine the funding required to either maintain the pavement system at its current PCI of 71 or to increase and achieve a PCI of 75. It was determined that a fiscal funding level of approximately $24.5 million annually for major rehabilitation and reconstruction projects would allow the desired pavement condition goal of an area-weighted PCI of 75 to be achieved through FY2027 and approximately $14.5 million annually to maintain the current area-weighted PCI of 71.

PROJECTED PAVEMENT CONDITION INDEX BY SCENARIO



The funding needs through FY2027 for each airport under an unlimited budget are summarized in the tables on the next page.

FY2022–FY2027 Unlimited Funding Needs

COMMERCIAL SERVICE/SCHEDULED CHARTER

Airport Name	2021 Area-Weighted PCI	6-Year Total Funding Needs
Cape Cod Gateway Airport - Barnstable Municipal Airport	81	$18.3M
Martha's Vineyard Airport	77	$13.9M
Nantucket Memorial Airport	74	$28.5M
New Bedford Regional Airport	76	$15.1M
Provincetown Municipal Airport	77	$2.4M
Westover Metropolitan Airport	65	$16.1M

CORPORATE/BUSINESS

Airport Name	2021 Area-Weighted PCI	6-Year Total Funding Needs
Beverly Regional Airport	74	$15.6M
Fitchburg Municipal Airport	69	$14.1M
Lawrence Municipal Airport	61	$27.7M
Marshfield Municipal Airport - George Harlow Field	68	$5.7M
North Adams Municipal Airport - Harriman-And-West Airport	83	$2.9M
Norwood Memorial Airport	71	$11.7M
Orange Municipal Airport	79	$3.1M
Pittsfield Municipal Airport	72	$11.1M
Plymouth Municipal Airport	67	$20.9M
Westfield-Barnes Regional Airport	71	$39.2M

FY2022–FY2027 Unlimited Funding Needs (cont.)

COMMUNITY/BUSINESS

Airport Name	2021 Area-Weighted PCI	6-Year Total Funding Needs
Chatham Municipal Airport	78	$1.8M
Falmouth Airpark	57	$1.1M
Great Barrington Airport - Walter J Koladza Field	31	$3.2M
Mansfield Municipal Airport	63	$6.5M
Minute Man Air Field	85	$0.6M
Northampton Airport	72	$2.5M
Southbridge Municipal Airport	72	$3.2M
Spencer Airport	5	$1.7M
Sterling Airport	49	$2.6M
Taunton Municipal Airport - King Field	65	$5.4M
Turners Falls Municipal Airport	71	$2.9M

ESSENTIAL/BUSINESS

Airport Name	2021 Area-Weighted PCI	6-Year Total Funding Needs
Cranland Airport	66	$0.8M
Gardner Municipal Airport	53	$4.3M
Hopedale Industrial Park Airport	20	$5.3M
Plum Island Airport	27	$1.8M
Tanner-Hiller Airport	8	$2.6M

SUMMARY



SUMMARY

Thirty-two airports are included in the MassDOT Aeronautics Division PMP: six commercial service/scheduled charter and twenty-six general aviation airports.

The total area of pavement included in the MassDOT Aeronautics Division PMP database is 42.3 million square feet. This can be further broken down into 16.3 million square feet of runway pavement, 10.9 million square feet of taxiway pavement, 11.1 million square feet of apron/helipad pavement, and 4.0 million square feet of taxilane pavement.

The pavement system has an area-weighted PCI of 71. Approximately 50 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, 50 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 63 and accrue a funding backlog of $398 million for major rehabilitation and reconstruction by FY2027.

If all the projects identified are funded, approximately $292.6million will be needed over the next 6 years: $94.4 million for commercial service/scheduled charter airports and $198.2 million for general aviation airports. Approximately $276.7 million is needed for NPIAS airport pavement work and $15.9 million for non-NPIAS airport pavement work.

To achieve the desired pavement condition goal of an area-weighted PCI of 75 for the entire system by FY2027, an annual expenditure of approximately $24.5 million is needed over the next 6 years for major rehabilitation and reconstruction projects.

To maintain the current area-weighted PCI of 71 for the entire system through FY2027, an annual expenditure of approximately $14.5 million is needed over the next 6 years for major rehabilitation and reconstruction projects.

The total cost of needs determined through this project reflects costs for pavement-related work itself and does not include any additional ancillary costs for items such as environmental studies, permitting, design, lighting, signage, drainage, construction monitoring, marking, or contingency fees.

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