Maine Medical Center
MaineHealth

Institutional Development Plan
Monitoring Report

November 2020

About the IDP Monitoring Report

DATE: November 10, 2020

STATUS: FINAL

INTRODUCTION

The IDP monitoring report summarizes Maine Medical Center's (MMC) progress on the MMC Institutional Development Plan (IDP) implementation and of acquisitions and divestments since its approval in September 2017. In accordance with the MMC Institutional Overlay Zone (IOZ) Regulatory Framework, monitoring reports shall be filed every three years to identify updates to the MMC IDP.

To access the approved MMC IDP and IOZ Framework, please visit:

http://www.portlandmaine.gov/1894/IOZ

This report begins with an Executive Summary, providing a high-level overview of progress. Next, the report discusses updated master planning, changes in baseline information, and changes in the adjacent neighborhoods which affect MMC, to allow the IDP to remain current. The report concludes with two (2) appendices, which help visualize MMC's action steps and engagement. For consistency, MMC intends to utilize this same (or similar) format in future reporting.

EXECUTIVE SUMMARY

Maine Medical Center is pleased to report progress on the implementation of our 2017 Institutional Development Plan. In accordance with the plan, MMC has made headway by updating clinical space and providing for the needs of patients and families, but also continuing to invest in its personnel and their ability to travel to and from the workplace and secure needed parking. MMC continues to balance and accommodate the many City of Portland goals and policies in a way that advances the City's overall best interests while at the same time addressing the high priority healthcare needs of Portland's residents and the people of the State of Maine.

The information provided in the report demonstrates MMC's institutional development since the 2017 IDP approval. It also provides updated datasets that capture the City's continued healthcare needs.

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CHAPTER ONE

INTRODUCTION

Updates

PROPERTY OWNERSHIP

MMC owns and leases a number of properties across the City of Portland. Updated lists of owned parcels and leased properties are presented in **Fig.1.7**, **Table 1.2,** and **Table 1.3** (on pg. 7 & 8).

Properties that have a functional relationship to the MMC Bramhall campus, which is the subject of this IDP monitoring report are highlighted on **Tables 1.2** and **1.3**. Per the requirements of the IOZ, a functional relationship is defined as uses or activities that are integrally linked to the day-to-day operations of the MMC Bramhall Campus, without which activity at MMC would be severely limited in one or more services.

Since the IDP approval, MMC has made the following changes to owned and leased properties:

- Property divestments:

117 High St., 429 Cumberland Ave.,
39 Forest Ave., 315 Park Ave., 85 St. James St., and 940-942 Congress St.

- Property acquisitions:

1127 Washington Ave., 1137 Washington Ave,
950 Congress St., 10 Andover Rd., 43 Baxter Blvd.

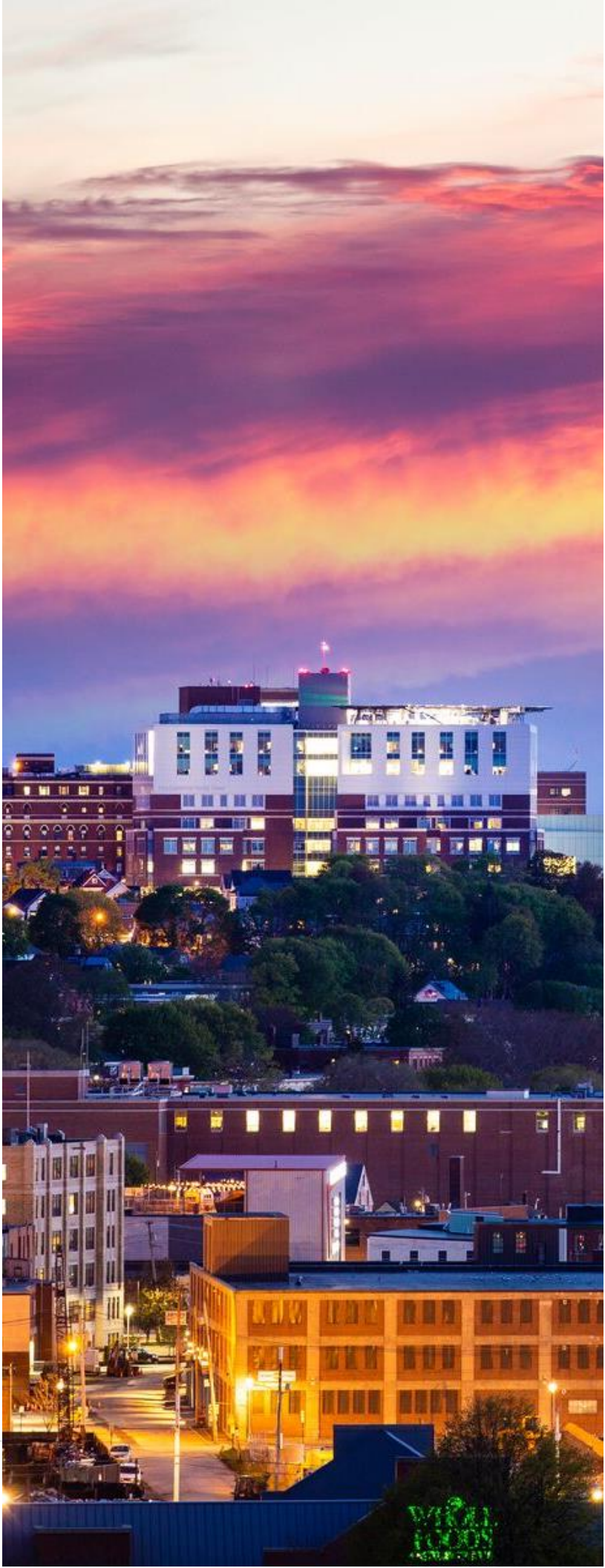


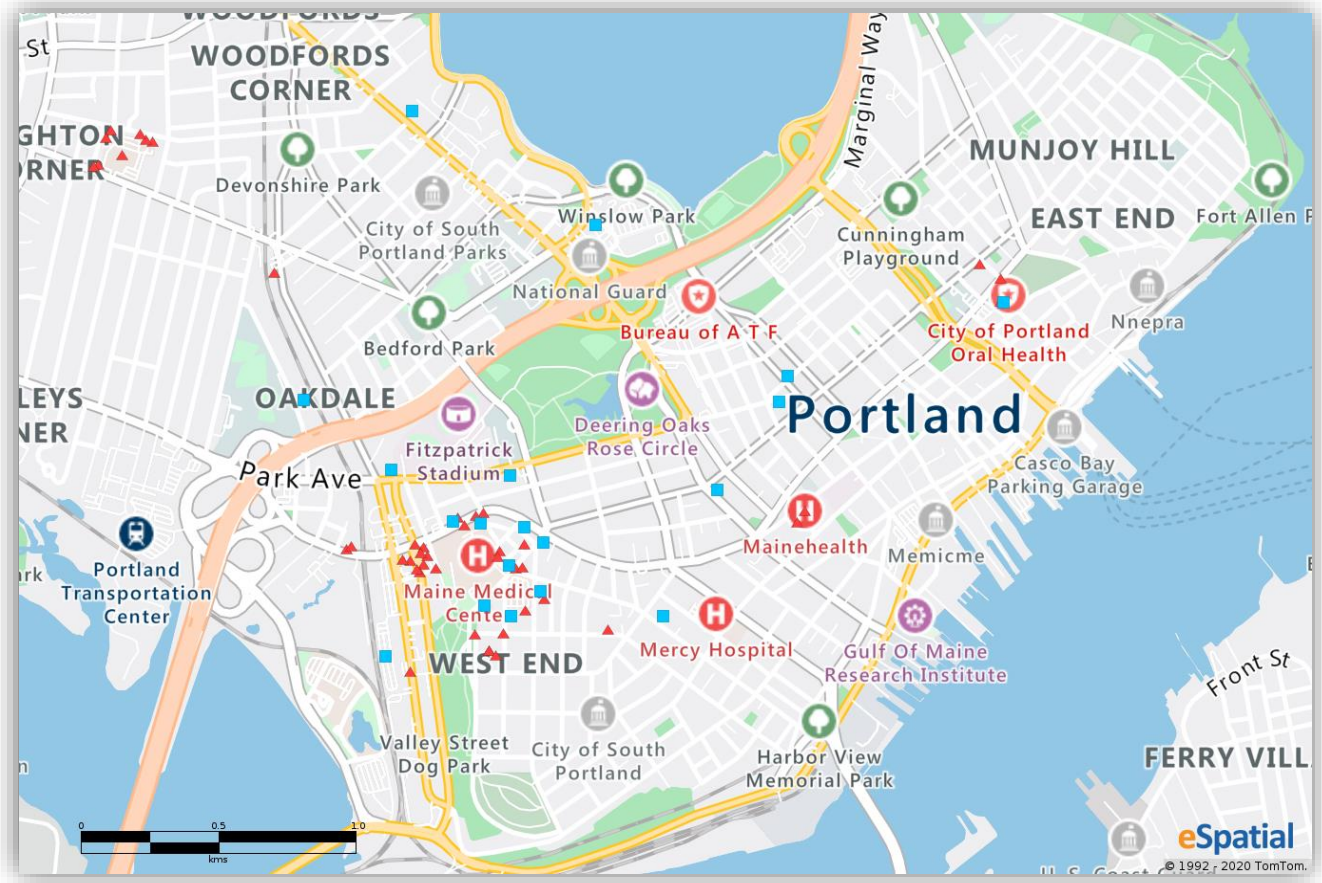
Fig 1.7 Map of MMC-Owned Parcels and Leased Properties

Table 1.2 List of Properties Owned by MMC within the City of Portland

Parcel Address	*Current Use*
100 Chadwick Street	Storage
1127 Washington Avenue	Residential
1137 Washington Avenue	Residential
120 West Street	Residential
136 Prospect Street	Residential
142 Prospect Street	Residential
146, 152, 156 Prospect Street	Land
148 Cumberland Avenue	Parking
174 Prospect Street	Residential
19 West Street	Medical
190 St. John Street	Parking
2 Smith Street (261-263 Congress)	Parking
216 Vaughan Street	Medical
229 Vaughan Street	Business
233 Western Prom	Residential
233 Western Prom – Rear	Storage
261 Valley Street	Parking
262 Valley Street	Parking
268-270 Valley Street	Land
272 Congress Street	Medical
274 Valley Street	Land
29 Hollis Road	Residential
321 Brackett Street	Business
335 Brighton Avenue	Medical
34 Ellsworth Street	Land
367 Brighton Avenue	Residential
40 Ellsworth Street	Land
42-46 Gilman Street	Parking
47 Bramhall Street	Business
48-52 Gilman Street	Medical
576 St. John Street	Medical
66 Bramhall Street	Medical
860 Congress Street	Land
870 Congress Street	Business
882 Congress Street	Parking
887 Congress Street	Medical
9, 15, 19, 23 Hollis Road	Land
930 Congress Street	Medical
932 Congress Street	Business
934 Congress Street	Business
94-96 Chadwick Street	Parking
950 Congress Street	Other
993 Congress Street	Parking
995 Congress Street	Business

Table 1.3 List of Properties Leased by MMC in the City of Portland

Parcel Address	*Current Use*
10 Andover Road	Medical
12 Andover Road	Medical
1250 Forest Avenue	Medical
131 Chadwick Street	Business
1577 Congress Street	Medical
180 Park Avenue	Business
181 High Street	Parking
183 Brackett Street	Residential
190 Riverside Street	Business
20 Portland Street	Medical
222 St. John Street	Business
233 Vaughan Street	Business
241 Oxford Street	Business
25-29 Crescent Street	Residential
295 Park Avenue	Business
325 Brackett Street	Residential
43 Baxter Boulevard	Medical
509 Forest Avenue	Business
7 Bramhall Street	Business
75 St. James Street	Storage
79 Bramhall Street	Business
818 Congress Street	Medical
87 Central Avenue	Medical
901 Washington Avenue	Business
905 Congress Street	Parking
98-100 India Street	Parking


WOODFORDS CORNER
Devonshire Park
City of South Portland Parks
Winslow Park
Marginal Way
MUNJOY HILL
EAST END
Fort Allen P
Cunningham Playground
National Guard
Bureau of A T F
City of Portland Oral Health
Nnepra
Bedford Park
OAKDALE
Deering Oaks Rose Circle
Portland
Fitzpatrick Stadium
Park Ave
Casco Bay Parking Garage
Mainehealth
Memicme
Portland Transportation Center
Maine Medical Center
Mercy Hospital
Gulf Of Maine Research Institute
WEST END
Front St
Valley Street Dog Park
City of South Portland
Harbor View Memorial Park
FERRY VILL
eSpatial
© 1992 - 2020 TomTom.


PRIDES CORNER
GRUBB HILL
WAITES LANDING
NORTH DEERING
VILLAGE OF HALIDON
Westbrook
DEERING JUNCTION
FORT LYON
LONG ISL
GREAT DIAMOND ISLAND
Maine Tpke S
DEERING
HIGHLANDS
TREFETHEN
EAST END
BRADLEYS CORNER
Portland
PEAKS ISLAND
County Rd
FERRY VILLAGE
Portland International Jetport
CUSHING ISLAND
295
South Portland
CAPE COTTAG
BROADVIEW PARK
Legend
Owned
Leased

CHAPTER TWO

MASTER FACILITY PLAN

Updates

KEY INSTITUTIONAL NEEDS

MMC's facility needs are multi-factorial but can be summarized into four categories:

1. Clinical Need
2. Building Need
3. Campus Reorganization
4. Parking Need

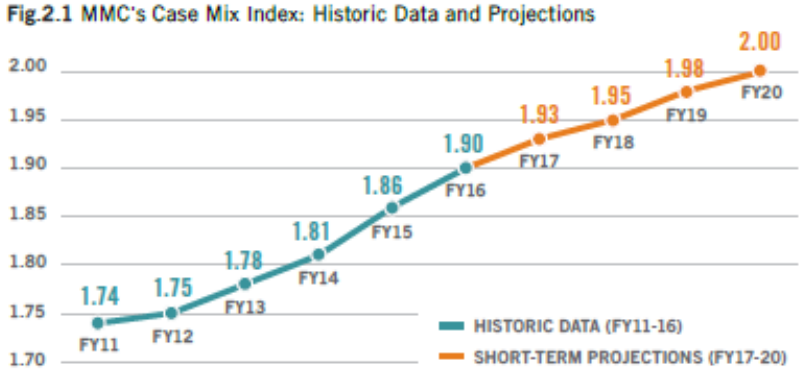
Information on building need, campus reorganization, and parking need remains current. Updates to clinical need baseline data and annual patient counts are presented below.

CLINICAL NEED

Increasing Severity of Case Mix Index (CMI)

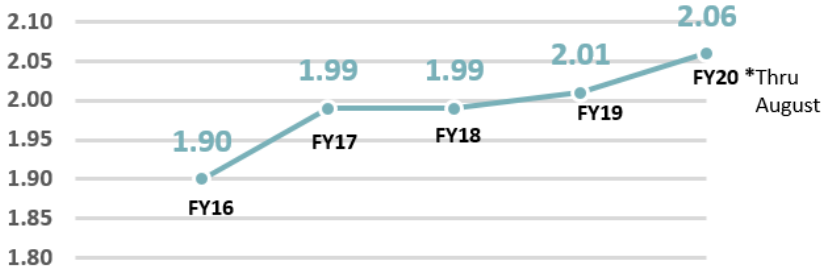
As expected, MMC has continued to treat Maine's sickest patients. In 2017, MMC presented **Fig. 2.1** to demonstrate MMC's historical and projected CMI.

Fig.2.1 MMC's Case Mix Index: Historic Data and Projections



An update to MMC's Case Mix Index is found in **Fig 2.2**. It shows that CMI has continued to increase and has exceeded projections.

Fig.2.2 MMC's Case Mix Index: Historic Data



PROJECTED DAILY CENSUS

While the number of patients, visitors, and employees on MMC's Bramhall campus varies day-to-day, a daily census estimate can be produced for a typical week day using a variety of data sources, including the annual patient count. **Table 2.3** presents the most recent annual patient counts.

Table 2.3 Historic Data: Annual Census of Patients on Bramhall Campus (FY 2017-2019)

	2017	2018	2019
Inpatient Discharges	30,668	31,687	31,965
Outpatient Activity	159,948	156,062	162,910
Bramhall Outpatient Clinics	39,414	40,902	42,582
TOTAL	230,030	228,651	219,672

CHAPTER THREE

TRANSPORTATION PLAN

Updates

TRANSPORTATION DEMAND MANAGEMENT

During the site plan reviews that followed the 2017 IDP approval, MMC submitted a campus-wide Transportation Demand Management (TDM) Program report substantially in accordance to those TDM objectives and strategies identified in the approved Institutional Development Plan. MMC's TDM Plan was approved in October 2018. The 2018 TDM Report is available on the MMC website and also linked here.

TDM Monitoring reports are submitted to the Portland Planning Authority on a yearly basis. These reports include a summary of progress toward achieving targets established in the TDM Plan. Please refer to Appendix A for the most recent TDM Monitoring Report (2019).

CHAPTER FOUR

ENVIRONMENTAL AND INFRASTRUCTURE PLAN

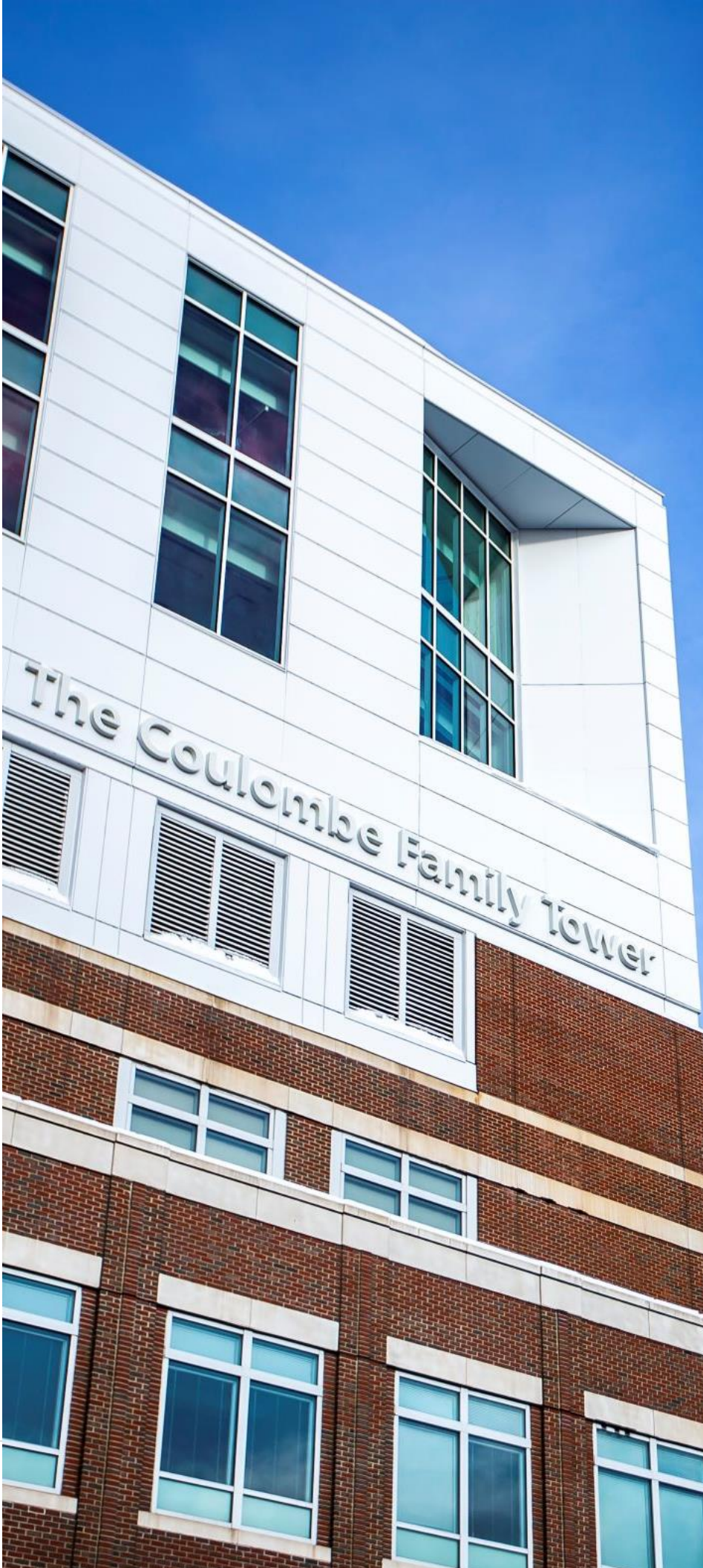
Updates

OPERATIONAL SUSTAINABILITY

Information on hazardous waste management and sustainable operations remains current.

Updated information on noise management related to the Helipad operations can be found in the MMC Sound Measurement Plan (SMP), which was submitted to the City of Portland Planning Board as a condition of approval for MMC's East Tower expansion project. The SMP describes the planned operations of air ambulances at MMC, and defines a noise complaint process related to air ambulance traffic at MMC. The plan provides a clear path forward for MMC and neighbors to better understand helipad operations.

Please find the 2019 Sound Management Plan in Appendix B.



CHAPTER FIVE

DESIGN

Updates

DESIGN

The information presented in the IDP regarding design drivers, neighborhood integration, and design guidelines remains current.

New buildings acquired since 2017 adhere to the guidelines set forth in Chapter 5: Design of the IDP and the site plans standards of the City of Portland.

In line with the IOZ Regulatory Framework, a unified campus-wide signage plan was submitted to the Portland Planning Authority in October 2019.

CHAPTER SIX

NEIGHBORHOOD ENGAGEMENT

Updates

ONGOING COMMUNITY ENGAGEMENT

Since construction on MMC's Master Facilities Plan began, MMC has been meeting monthly with the Neighborhood Advisory Council (NAC). Hosted by MMC, this group consists of the medical center's chief operating officer and representatives from the following Neighborhood Associations: St John Valley, Western Promenade, West End, Parkside and Libbytown, as well as the District 2 Portland City Councilor and a representative from the Portland Planning Department.

This group has developed a charter, governing the conduct of the meetings, and minutes are posted on the MMC website linked here.

Through these monthly meetings and the relationships established within them, MMC and neighborhood leaders have established an information sharing dynamic that allows the medical center to learn and understand more about its impact on surrounding areas, discuss possible solutions and also convey information out to neighbors through the association leaders.

Some of the topics discussed and addressed in this manner include:

- Operations of the new helipad;
- Traffic flow changes due to construction projects;
- Updates on Master Facilities Plan;
- Property purchases within the IOZ;
- Impact of COVID-19 on hospital operations; and more.

COMMUNITY BENEFITS

The NAC has developed a framework for the disbursement of funds to neighborhood groups through the "Caring Community" grant program, administered by the NAC and funded annually by MMC with $30,000. These funds are available to neighborhood associations or other entities in the St. John Valley, Parkside, West End, Western Prom and Libbytown neighborhoods. Groups will be able to apply for these grants for a variety of initiatives, including those that promote quality of life, diversity and inclusion, public safety, environment sustainability and the general support of strong, safe, accessible and vibrant neighborhoods.

MMC also supported the installation of holiday lights in Bramhall Square with a one-time $6,000 grant, and provided the City of Portland $300,000 for investments in parks in the Western Prom, Parkside and St. John Valley neighborhoods, affirming MMC's commitment to the neighborhoods it belongs to, as well as its appreciation for the continuing collaboration and open dialogue it shares with city and neighborhood leaders.

For more information on the vast community benefits provided by MMC, visit the linked page.

HEALTHY NEIGHBORHOOD PROGRAM

MMC fulfilled its obligation to initiate a process by which a memorandum of understanding was adopted between MMC, the City of Portland, an identified Community Housing Development Organization and any other community partners that may be identified later establishing a program to fund and execute housing and community improvement and development programs in St. John Valley and other neighborhoods surrounding MMC's Bramhall Campus. However, no such agreement is in place as of the date of this monitoring report due to unforeseen variables.

The City of Portland led the development of a request for proposals for a community housing development organization. Only one organization provided a proposal which did not meet the expectations of the neighborhood associations. Discussion between the City of Portland and the neighborhood associations are ongoing.

CONSTRUCTION MANAGEMENT PRINCIPLES

Throughout the MFP construction project, MMC has made every effort to share information transparently, and to listen to neighborhood feedback.

Ahead of public hearings for each phase of the project, MMC hosted neighborhood presentation/listening sessions, which were well attended by area residents and business owners. One example of accommodation to neighbors came about as construction began on the expansion of the East Tower, now known as the Coulombe Family Tower.

Due to a temporary change from one-way traffic to two-way traffic, residents on Crescent Street lost on-street parking. MMC provided those residents with parking in the nearby MMC-owned parking garage for the duration of that change.

During the closure of Congress Street to accommodate expansion of visitor parking, MMC utilized social media, earned media and direct neighborhood flyering and face-to-face communications to give details on detours, construction plans and more.

The detours and project went extremely well and swiftly, prompting this response from City Manager Jon Jennings:

"We'd like to thank Maine Medical Center for working in cooperation with city officials and neighborhood residents on the planning and execution of this shutdown and detour, and for committing the necessary resources in order to get it done ahead of schedule."

Throughout the project MMC has maintained a web page – linked here - dedicated to news about construction, and has provided weekly look-aheads regarding the next week's pending work. Area residents and business owners have signed up for a service that allows them to be notified by text or email every time a new project update has been added. And contact information for all on-going project sites is clearly listed on the page, as well.

APPENDICES

Appendix A: 2019 MMC TDM Annual Monitoring Report

Appendix B: 2018 MMC Sound Measurement Plan

Appendix A: 2019 MMC TDM Annual Monitoring Report

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Commuter Choice
(Formerly the "Get on Board!" program)

Maine Medical Center Transportation Demand Management (TDM) Plan: Annual Report, September 2019

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Appendix A: 2019 MMC TDM Annual Monitoring Report

Annual TDM Report

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To:	City of Portland Planning Division
From:	Maine Medical Center (MMC), Planning Department
Date:	September 2019
Re:	Annual TDM Update

Contents

Appendix A: 2019 MMC TDM Annual Monitoring Report

Introduction

This annual monitoring report summarizes Maine Medical Center's (MMC) progress towards achieving goals and targets outlined in the MMC Transportation Demand Management (TDM) Plan approved by the City of Portland along with the Site Plan of MMC's St John St Parking Garage on September 11, 2018. The report begins with an Executive Summary, providing a high-level overview of progress. Next, the report discusses data collection techniques and is followed by detailed summaries of MMC's progress in achieving and implementing individual goals and strategies. The report concludes with four (4) appendices, which help visualize MMC's action steps and engagement. For consistency, MMC intends to utilize this same (or similar) format in future reporting.

Executive Summary

MMC is pleased to report that we surpassed our short-term goal of reducing employee parking demand (and single-occupancy vehicle travel) to our Bramhall campus. In addition, MMC has made significant progress in achieving the strategies outlined in our 2018 TDM Plan (summarized below and detailed in this report). MMC will continue efforts to reduce single-occupancy vehicle travel to our facilities, while being a local, regional, and national leader in TDM.

Short-term Strategies (1-5 Years)	
✓	TDM Program Manager
✓	Way 2 Go Maine
☐	Parking Fees (evaluate pricing)
✓	Bike Parking
◔	Data Collection and Annual Reporting
◔	Guaranteed Ride Home
Long-term Strategies (5+ Years)	
◔	Regional Collaboration
✓	Transit Partnerships
Education and Marketing Strategies	
✓	Orientation Materials
✓	Social Media
✓	TDM Booths
✓	Leverage Existing MMC Programs
✓	Branding
✓	Fairs/Seminars
✓	TDM Blitz
✓	Commuter Challenges

KEY

✓ Complete

◔ Progress

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Data Collection

MMC understands from its prior TDM experience that achieving change is an iterative process that involves tracking the effectiveness of its programming and making any necessary mid-term adjustments. MMC regularly collects and analyzes data to monitor progress towards its TDM targets. The data is collected through various techniques and can be used to make annual comparisons, evaluate trends, and identify opportunities for improvement. Several of the existing techniques and potential future techniques are discussed Table 1 and Table 2, respectively.

Table 1: Existing Data Collection Techniques (Examples)

Data Collection Technique	Details
Employee Surveys	Employee surveys can provide a snapshot sample of commuting patterns, which can be used to make inferences about the commuting patterns for the larger employee population. The most recent survey, conducted in 2017, provides a useful benchmark for this annual report (discussed in the next section).
Commuter Choice Website Registrations	MMC staff can voluntarily register for Commuter Choice, the hospital's alternative commuting program. By registering, staff can be "in the know" about alternative commuting news, as well as program enhancements. The registration portal asks participants about their home location, work location, shift, alternative commuting patterns, and also provides an opportunity for input. This registration data provides MMC with valuable commuting data, which can be used to infer commuting patterns for the employee population, particularly when used in tandem with other data (e.g. transit ridership data).
Bus Pass Sales	MMC has tracked bus pass sales on a monthly basis for the past three (3) years. Moving forward, MMC will utilize bus ridership data that is collected and provided by the transit agencies as part of the MMC's employee bus pass program (discussed in Table 2.
Observations	MMC Parking and Commuter Choice program leaders periodically assess utilization of carpool parking and bicycle parking. For example, bicycle parking surveys were conducted as part of the Bicycle Parking Assessment, which was submitted to the City in Spring 2019. While these assessments provide anecdotal data, their results can vary based on weather, time of day, and seasonality. In addition, observations provide valuable validation of other data sources.
Go Maine Data	MMC utilizes Go Maine data to measure staff participation in commuter challenges, such as the Way 2 Go Maine Challenge (October 2018), the MMC Carpool Challenge (April 2019), and the MMC Active Commuter Challenge (May 2019). The results are summarized later in this report.

Table 2: Potential Future Data Collection Techniques (Examples):

Data Collection Technique	Details
Transit Ridership Data	As part of MMC's employee bus pass program, transit agencies will provide anonymous monthly data on employee bus ridership. The data will summarize ridership by route and time and will help MMC measure transit ridership over time and gauge the effectiveness of future TDM efforts.
Parking Utilization Data	MMC will utilize a parking guidance system in the new employee garage, which will allow MMC to monitor occupancy (via technology similar to that used in EZ-Pass) and understand the temporal fluctuations in parking demand across various periods of time. These systems will provide quantifiable information to assist in evaluating future parking demand.
Commute Management Platforms	MMC continues to explore various commute management platforms to better understand, manage, and influence employee commuting behavior. The platforms are typically mobile and desktop-friendly and allow employees to easily log daily commutes, while giving employers the ability to manage commuting programs, data, and rewards in a centralized system. The platforms can help raise awareness for alternative transportation choices, engage (and possibly reward) employees, and provide the data and tools to make informed transportation decisions.

Reduction in Single-Occupancy Vehicle Commuting

Recap of Baseline and TDM Plan Targets

In 2017, MMC conducted a baseline survey to understand how our employees commute, identify barriers to using alternative transportation, and to discern the interest in potential TDM initiatives. The results indicated that approximately 90.6% of employees drive alone to work (Table 3). This represents 5,438 single-occupancy vehicle (SOV) commuters.[1] While the survey data provides an estimate for commuting mode share, its results are not statistically significant and certain commuting populations may be overrepresented or underrepresented. For example, the results suggest that only 0.3% bike to work, which likely underestimates the true share of bike commuters (based on employee bike parking assessments).

Table 3: Estimated Commuting Mode Share (2017)

Commuting Mode	Estimated Percent of Employees
Drive alone	90.6%
Carpool/Vanpool	2.5%
Walk	2.2%
Bike	0.3%
Transit	0.3%
Other	4.0%
Total	**100.0%**

Source: MMC TDM Survey (2017), scaled to 22 Bramhall employee population. Respondents did not specify "Other" mode.

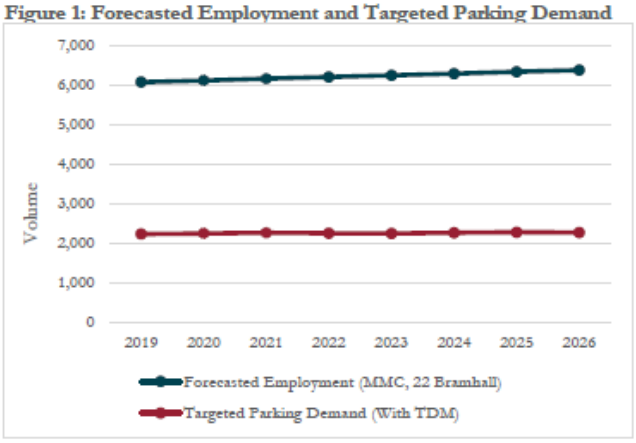
[1] The survey had a ~40% response rate. This equates to a 2-3% margin of error at a 95% confidence level. Margin of error, also called the confidence interval, statistically measures the difference between survey results and the population size. For the TDM survey, the margin of error measures how accurately the survey results reflect the commuting behavior of the MMC workforce.

MMC's TDM Plan (2018) estimated current parking demand, along with short, mid, and long-term goals to reduce parking demand (reduce the number of employees driving alone to work). The summary below shows a short-term goal to reduce parking demand by 46 spaces.

- Estimated 2019 employee parking demand per employee (without TDM): .38 spaces per employee, equivalent to 2,282 spaces.
- Targeted 2019 parking demand per employee (with TDM): .37 spaces per employee, equivalent to 2,236 spaces – reflects short-term goal (0-2 years) to reduce employee parking demand by 2%, equivalent to 46 spaces.

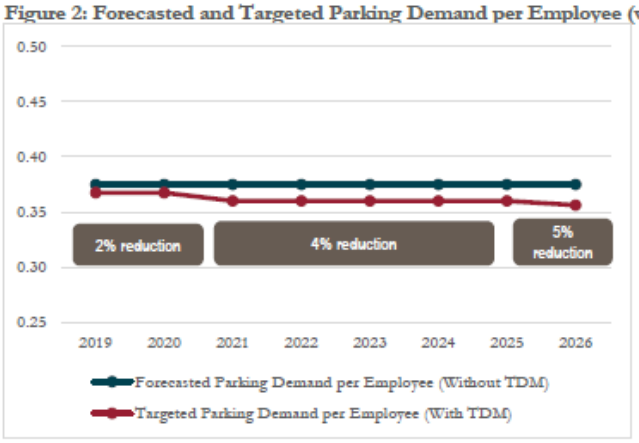
Figure 1 shows forecasts for employment and parking demand through 2026, with employment increasing and parking demand remaining stable over time. Figure 2 shows targeted diminishing parking demand per employee through 2026 as a result of TDM, compared to a scenario without TDM.

Figure 1: Forecasted Employment and Targeted Parking Demand



Employment at MMC is expected to continue to increase through 2026, while parking demand is expected to remain relatively flat over the same time period (due to current and anticipated TDM efforts).

Figure 2: Forecasted and Targeted Parking Demand per Employee (with and without TDM)



MMC's TDM initiatives are expected to reduce parking demand per employee despite anticipated increases in employment at the 22 Bramhall campus.

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Although MMC's existing parking facilities do not have the technology to adequately measure current parking demand, MMC' Commuter Choice registration data (discussed above) can be used to reasonably measure progress towards meeting the short-term goal. In order to reduce parking demand, MMC strives to reduce the number of single-occupancy vehicle (SOV) commuters to the Bramhall campus. Assuming a reduction of 46 SOV commuters, MMC would need to reduce SOV commuting from 90.6% of Bramhall employees (2019) to 89.9% of Bramhall employees (2019) in order to accomplish its short-term goal.

Progress Report

Using Commuter Choice registration data, MMC estimates that 88.2% of employees currently drive alone to work, suggesting that MMC has exceeded its short-term goal (89.9%) of reducing the number of single-occupancy vehicle commuters. This is equivalent to a 2.7% reduction in parking demand (147 parking spaces), exceeding the short-term goal of 2.0% (46 spaces). The detailed breakdown by commuting mode is shown in Table 4.

Table 4: Estimated Commute Mode Share (2019)

Commuting Mode	Estimated Percent of Employees
Drive alone	88.0%
Carpool/Vanpool	4.4%
Walk	2.8%
Bike	1.9%
Transit	2.5%
Other	0.2%
Total	100.0%

Source: Commuter Choice Registration Data (Alternative Commuting Program for MMC).
The registration portal asks participants how often they commute by alternative transportation.

Short-term Strategies (1-5 Years)

Progress	Strategy	Action Steps
✓	TDM Program Manager	• Hired full-time TDM Program Manager (July 2018)
✓	Way 2 Go Maine	• 1st place in Way 2 Go Maine challenge for large organizations (October 2018) – logged 2,780 trips, over 1,000 more than 2nd place finisher. *See Appendix A.*
☐	Parking Fees (evaluate pricing)	• To be evaluated in the future
✓	Bike Parking	• Provided Bike Parking Assessment (May 2019), showing planned changes to the bicycle parking on the Bramhall campus. Satisfies Condition #12 of the East Tower & Visitor Garage Approval • Provided Supporting Bike Parking Documentation (June 2019), showing photos of existing/proposed bike parking locations • Ordered new bike racks: 120 spaces, "inverted u" style (August 2019).

Progress	Strategy	Action Steps
	Data Collection and Annual Reporting	• Submitted annual report (September 2019) • Tracked bus pass sales, showing 16% year-over-year increase from CY17 to CY18. *See Appendix A.* • Tracked unique daily visits to Commuter Choice website and Commuter Choice registrations. Experienced surge in website activity and registrations with launch of FREE bus program. 420 employees were registered for the Commuter Choice program as of August 5, 2019. *See Appendix A.* • Formulated data-sharing agreement with transit agencies as part of FREE employee bus program • Evaluating data collection enhancements per TDM Plan • Plan to launch another employee commuting survey in Fall 2019 or Spring 2020
	Guaranteed Ride Home	• Utilize Go Maine's Guaranteed-Ride-Home Platform, which recently expanded to include taxi service in the Portland area

Long-term Strategies (5+ Years)

Progress	Strategy	Action Steps
	Regional Collaboration	• Participate and serve on the PACTS regional Transit Committee • Participate on the Maine Transit Advisory Council; presented findings to State Legislature, advocating for additional investment in public transit. *See Appendix B.* • Participate on the Transit Tomorrow Advisory Committee • Participated in discussions about a Transportation Management Association (TMA)
	Transit Partnerships	• Participate in various regional and statewide transit committees (*above*) • Implemented FREE employee bus program for travel on Metro, South Portland Bus Service, and ShuttleBus-Zoom. Employees can now board the buses by showing their employee badge (no tickets or passes needed). This benefit is good any time, any day, for unlimited travel.

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Education and Marketing Strategies

Progress	Strategy	Action Steps
✓	Orientation Materials	• Developed new Orientation materials (September 2018) • Revised Orientation materials (July 2019) to reflect FREE bus program. *See Appendix C.*
✓	Social Media	• Bike to Work Day (May 2019). *See Appendix C.*
✓	TDM Booths	• Commuter Choice booth (September 2019). *See Appendix C.* • Commuter Choice/Amtrak booth (scheduled for September 2019)
✓	Leverage Existing MMC Programs	• Encourage active commuters to use MaineHealth's activity tracking app. for up to $300 per year in rewards. • Collaborate with Works on Wellness Program (Wow!) - integrated Commuter Choice information into the Wow! app. *See Appendix C.*
✓	Branding	• Rebranded TDM program (August 2018), changing the name from "Get on Board" to "Commuter Choice" (below). *See Appendix C.* Commuter Choice
✓	Fairs/Seminars	• Hosted two (2) Alternative Commuting Information sessions for MMC's Environmental Services department, the largest department at the hospital (June 2019). *See Appendix C.* • Presented at several MMC/MaineHealth leadership meetings (June, July 2019)
✓	TDM Blitz – Way 2 Go Maine	• Published two (2) MMC eNews articles about Way 2 Go Maine Challenge. *See Appendix C.* • Worked with a team of alternative commuters to market the challenge • Hosted Way 2 Go Maine booth in the MMC cafeteria; provided giveaways; raffled off bike lights and a new helmet ($200 total value), courtesy of Cyclemania. *See Appendix C.*
✓	Commuter Challenges	• Carpool Challenge (April 2019) – 60 participants, 1,400 trips logged (16,400 miles), 7.3 tons of Co2 reduced, $200 in gift cards awarded. *See Appendix C.* • Active Commuter Challenge (May 2019) – 60 participants, 1,600 trips logged (2,000 miles), 1.2 tons of Co2 reduced, $200 in gift cards awarded. *See Appendix C.*

Additional Strategies (Outside Scope of TDM Plan)

Strategy	Action Steps
Explore Bikeshare	• Brainstormed ideas with Sam Herr, Executive Director of the North American Bikeshare Association • Communicated with TDM staff at Penn State University to learn about their experiences with bikeshare • Participated in several meetings with the University of New England (UNE), exploring the potential to "rent" UNE's bikes during the summer months (while students are not in session). MMC and UNE developed an informal agreement, which was rejected by the Zagster, UNE's bikeshare vendor.
Abandoned Bikes	• Established an Abandoned Bicycle Policy for MMC • Tagged, removed, and donated 7 bicycles to Portland Gear Hub
Bike Lockers	• Cleaned and serviced bike lockers; assigned additional keys to active bicycle commuters (November 2018). *See Appendix D.*

Conclusion

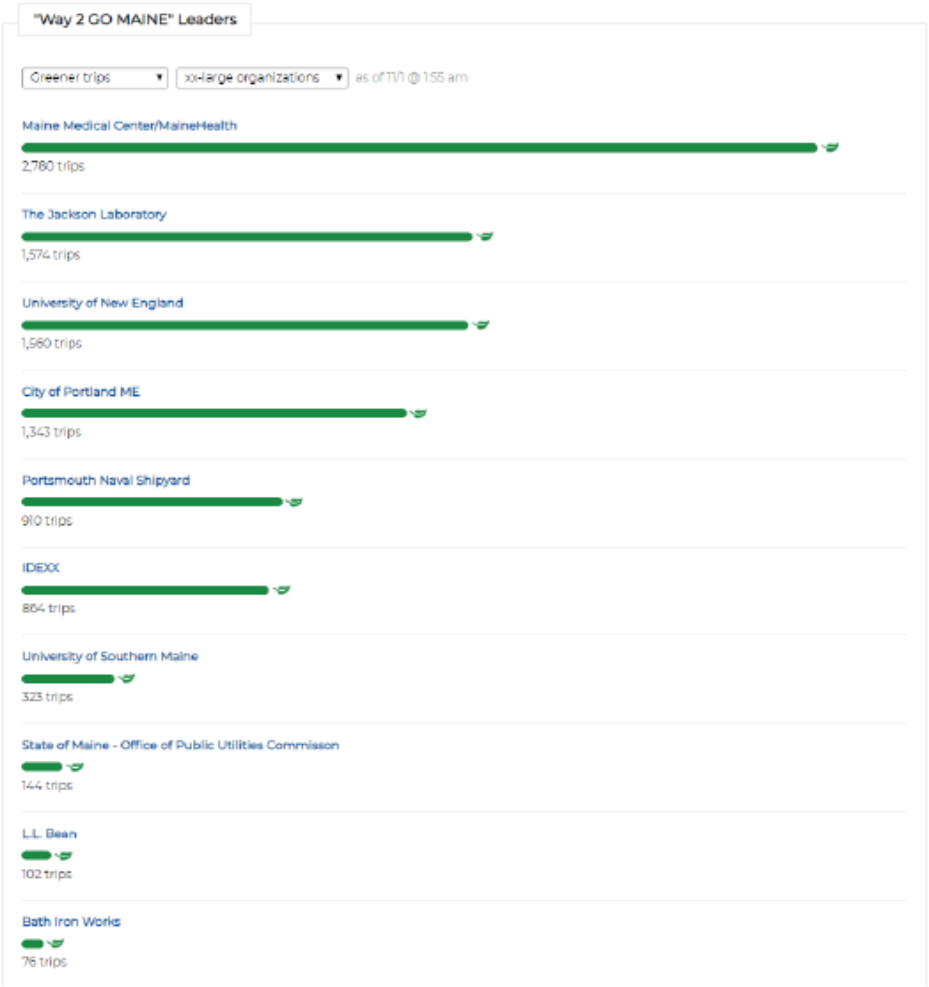
MMC is pleased to report that we surpassed our short-term goal of reducing parking demand and single-occupancy commuting to the 22 Bramhall campus. In addition, MMC has made significant progress in achieving those short-term, long-term, and education/marketing strategies outlined in the 2018 TDM Plan. MMC will continue to enhance and expand its TDM program, while serving as an alternative commuting leader in Portland and beyond.

The following Appendices showcase MMC's vast TDM "playbook", highlighting the range of strategies, actions, and contributions over the past year.

MMC looks forward to delivering future annual updates in a format similar to that provided in this report.

Appendix A: Short-term Strategies (Exhibits)

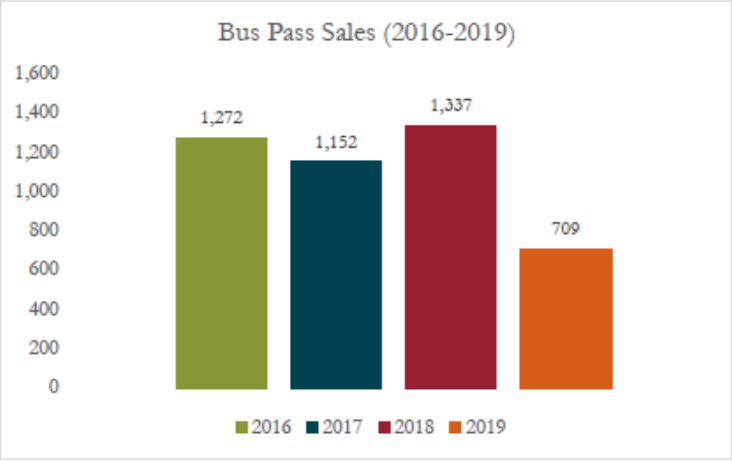
Way 2 Go Maine



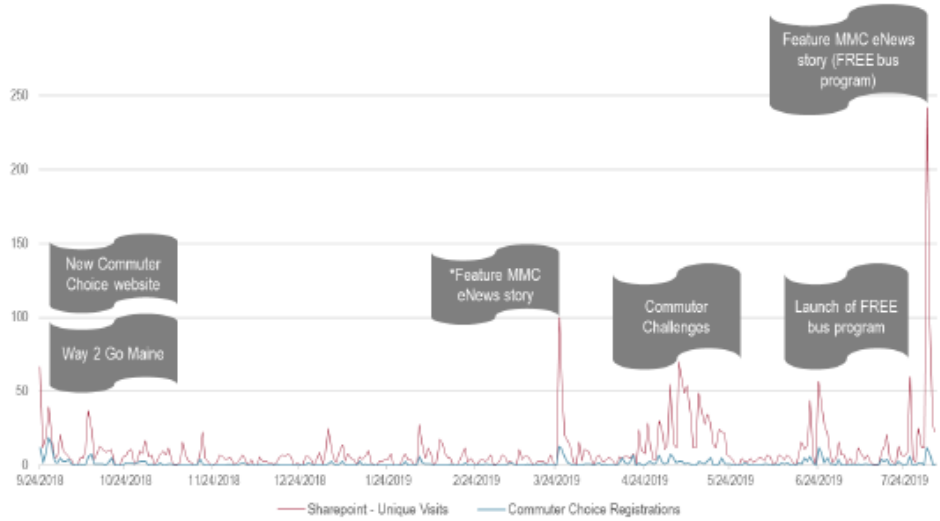
Way 2 Go Maine 2018, Final Leaderboard

Way 2 Go Maine 2018. MMC employees receiving award for 1st place finish.

Data Collection



*Bus Pass Sales (CY 2016- CY 2019). *CY 2019: data through June, on pace for 1,418*
Reflects quarterly, monthly, and 10-ride passes



Commuter Choice Website (Sharepoint) Unique Visits and Commuter Choice Program Registrations (September 24, 2018 – August 5, 2019). Over 420 employees were registered for the Commuter Choice program as of August 5, 2019.

Appendix B: Long-term Strategies (Exhibits)

Public Transit Advisory Committee

Public Transit Advisory Council: Legislative Summary

Needs and Recommendations

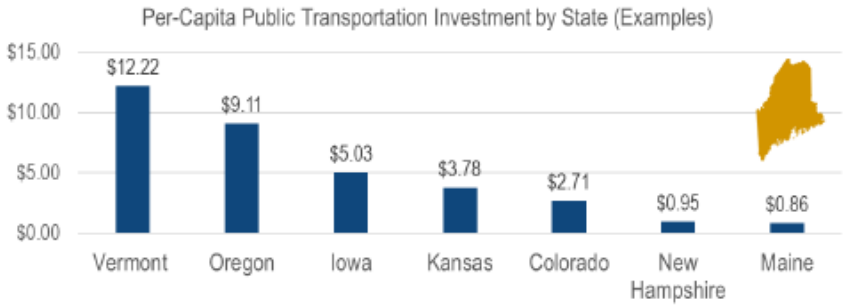
MaineDOT

Public Transportation Needs:

40,892 Maine households do NOT own a personal vehicle

1 in 5 Maine residents will be older adults (65+) by 2020

Maine ranks 38th in per-Capita Public Transportation Investment by State DOT:



Funding Recommendations

SHORT-TERM GOAL: Raise Maine to median state funding level of $5/capita

PROPOSED FY20 INVESTMENT: $6.8 million (~$5/capita)

PROPOSED DISTRIBUTION:
- 50% formula
- 50% through competitive process

Maine Public Transit Advisory Committee, Summary Sheet for Legislature. Prepared by Chris Chop, Program Manager.

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Maine Medical Center
MaineHealth

Free Bus Program (Portland Press Herald Article)

BUSINESS > Posted June 21 | Updated June 26

INCREASE FONT SIZE

MaineHealth gives employees in Portland area free bus passes

About 10,000 workers can ride public buses in Portland and South Portland for free as part of a traffic-calming initiative by the health care company.

BY PETER MCGUIRE STAFF WRITER

Share

MaineHealth will offer its Portland-area employees free public transit in an effort to reduce traffic congestion and parking issues around its expanded flagship hospital on Congress Street in Portland.

About 10,000 workers at Maine Medical Center and at least six other MaineHealth offices in and around Portland will only have to show their employee badge to board Greater Portland Metro buses and shuttles and South Portland buses for free.

"We are taking this important step in order to reduce vehicle traffic on our roads and to help the environment, supporting our vision of working together so our communities are the healthiest in America," Jennifer McCarthy, Maine Medical Center chief operating officer, said in a statement.

"It also provides an attractive option to colleagues who want to make that positive impact while saving money on gas, vehicle maintenance and, now, public transportation costs."

MaineHealth signed a three-year agreement with Metro for the service. The passes are sold at a 67% of the regular price, said Metro general manager Greg Jordan. The hospital company will be billed for how many workers use the bus, he said.

BROWSE MORE IN BUSINESS

MAINE CANNABIS REPORT
PEOPLE ON THE MOVE
BUSINESS BREAKFAST
MAINE COMMERCIAL REAL ESTATE
MAINEJOBS.COM

Portland Press Herald article on MMC's Free Bus Program

Appendix C: Education and Marketing Strategies (Exhibits)

Orientation Handout

Commuter Choice

Did you know that Maine Medical Center offers **resources and incentives,** like FREE bus rides, for those who commute by alternative transportation, like: transit, carpooling, walking, and cycling?

Which alternative works best for you?

Carpool/Vanpool Incentives: Parking reimbursement, commuter challenges/cash giveaways, and preferred parking employee garage

Transit Incentives: Parking reimbursement and FREE bus rides on Metro (includes Breez) South Portland Bus Service, and Shuttle-Bus Zoom *(just show your employee badge to the bus driver and enjoy the ride on us!)*

Active Transportation Incentives: Parking reimbursement, commuter challenges/cash giveaways, and Virgin Pulse points/cash through our Works on Wellness (Wow!) program

Maine Medical Center
MaineHealth

Orientation handout (August 2019)

Visit "Special Programs → Commuter Choice" on the MMC intranet site to register and learn more!

Questions? Contact CommuterChoice@mmc.org

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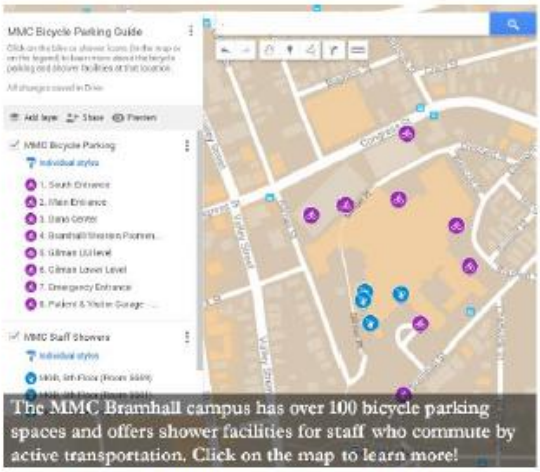
Maine Medical Center
MaineHealth

Appendix A: 2019 MMC TDM Annual Monitoring Report

Website

Commuter Choice website (home page, screenshot)



Commuter Choice website (bike parking, shower locations)

Maine Medical Center
MaineHealth

Social Media

Bike to Work Day Facebook Post (May 17, 2019)

Branding

Commuter Choice

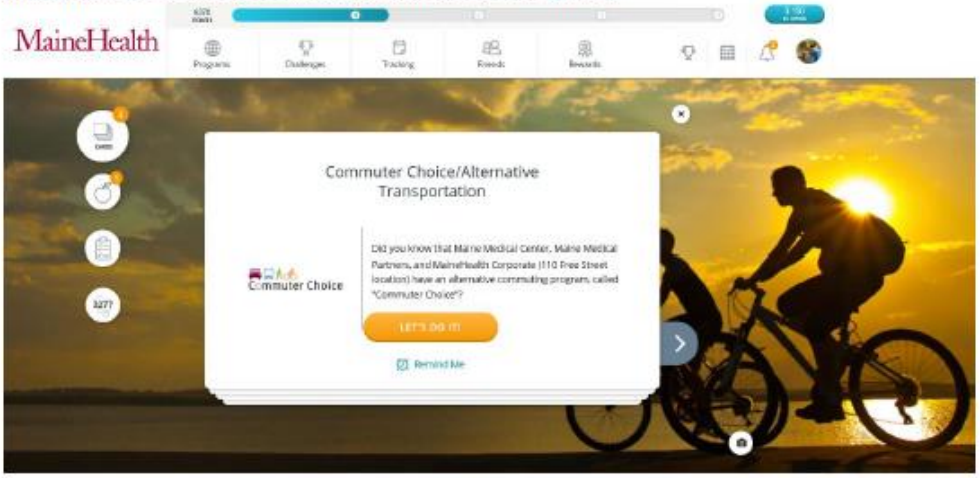
Commuter Choice logos

Commuter Choice

Fairs/Seminars

Commuter Choice booth at MMC cafeteria

Integration with other Maine Medical Center Programs



Commuter Choice marketing on the MaineHealth Works on Wellness program dashboard

Appendix A: 2019 MMC TDM Annual Monitoring Report

MMC/MaineHealth eNews (Examples)

Free Bus Program Expands

Commuter Choice

In addition to previously announced free rides on Metro Bus or South Portland Bus, MaineHealth employees in the Portland area will also be able to board ShuttleBus-ZOOM for free, as of August 1.

ShuttleBus-ZOOM is a service that runs commuter routes between Portland and Biddeford.

Just show your employee badge to the bus driver and enjoy the ride on us (no tickets or passes needed)! Beginning early 2020, Metro plans to install digital readers on all buses, at which point employees will scan their badges in order to board the bus.

The Metro program includes the HUSKY and BREEZ routes, serving the Portland-Gorham corridor and Portland-Brunswick corridor, respectively.

Want to learn more about alternative commuting benefits? Register for the Commuter Choice program.

Questions? Contact CommuterChoice@mmc.org

MaineHealth eNews Article about the FREE bus program

MMC eNews

MONDAY, MARCH 25

Carpool Challenge

April 1 - April 30
$200 value in prizes

Join a month-long carpool commuter challenge where staff compete for various prizes!

Log your daily carpool commutes at GoMaine.org or through the Go Maine app. You will need to register for Go Maine if you haven't already.

Eligibility: Staff from MMC, MMP, and MaineHealth Corporate (Portland).

Grand Prizes: Gift cards will be awarded for most trips logged and biggest reduction in CO2 (multiple winners for each) and all participants will be eligible for a raffle drawing.

Stay tuned for future commuter challenges, like the Bike Month Challenge, coming in May.

Learn more about the MMC/MH Commuter Choice program here or visit the Intranet under "Special Programs > Commuter Choice."

Questions? CommuterChoice@mmc.org

MMC Feature eNews article about the Carpool Challenge

Alternative Commuting at MMC

Learn About MMC's Alternative Commuting Program
Wednesday, Sept. 26
11:30 a.m. - 1:30 p.m.
Impressions Café, Bramhall Campus

Commuter Choice
(Formerly the "Get on Board!" program)

MMC encourages all colleagues to try different ways of getting to work through its "Commuter Choice" program. Commuter Choice (formerly "Get on Board") provides resources and rewards for colleagues interested in alternative commutes, such as: carpooling, using public transit, walking, or cycling.

Stop by the cafeteria on Wednesday from 11:30 a.m. to 1:30 p.m. to learn more and meet Chris Chop, the new Commuter Choice coordinator.

Visit the new Commuter Choice page on the Intranet.

Questions? Chris Chop, 662-4120

Sign Up Now for Alternative Commuting Challenge

GO MAINE is holding the second annual Way 2 GO MAINE employer challenge in October. This event encourages and rewards Mainers to use GREEN alternative commutes, such as: carpooling, transit, walking or cycling.

MMC staff participated in 2017 and recorded the second-most green trips for large organizations. Can we finish first in 2018? Participating is easy, fun and you can earn rewards when you log commutes.

Sign up for GO MAINE, and start recording your green trips. If you are already signed up, simply make sure you record your green trips. Encourage your colleagues to do the same.

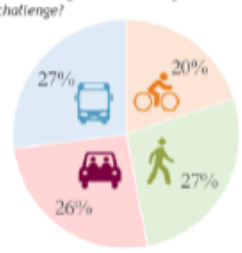
MMC eNews article about Way 2 Go Maine Challenge

MMC/MH Finishes First in Way 2 Go Maine Challenge

We did it! Maine Medical Center/MaineHealth finished first in the 2018 Way 2 Go Maine Challenge. Together, MMC/MH staff logged 2,780 "green trips," roughly 1,200 more trips than the second place finisher. Thanks to all of the participants for reducing congestion on our streets and improving air quality.

Read more.

How did MMC/MH participants get to work during the month-long challenge?



MMC eNews article, showcasing results of the Way 2 Go Maine Challenge

Commuter Choice

BIKE TO WORK DAY
Friday, May 17, 2019

Thanks for biking to work!
Treat yourself to some breakfast on us!

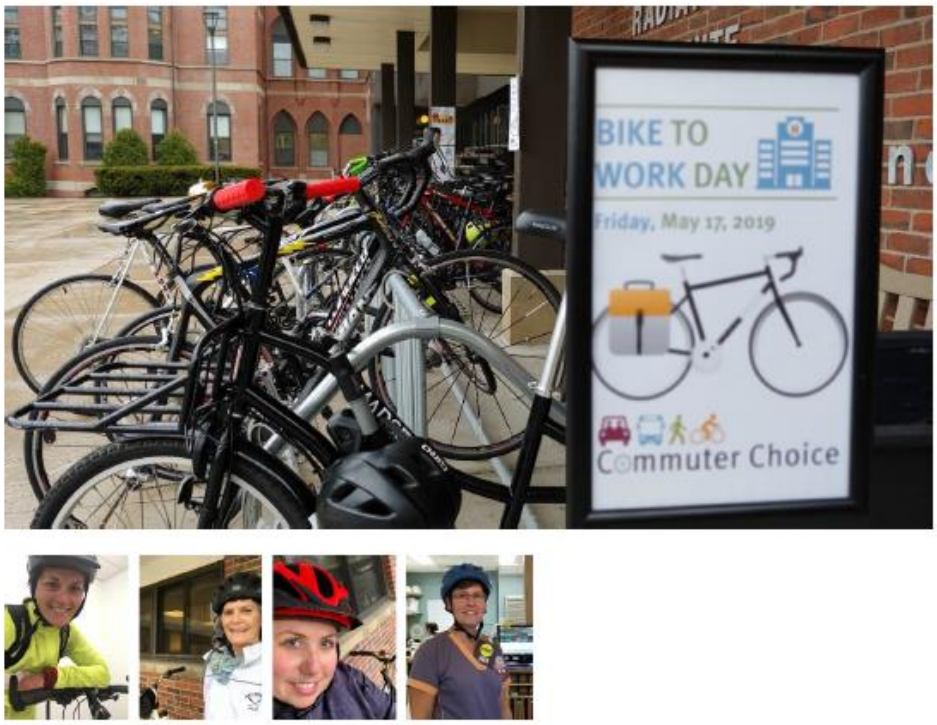
And sign in for a chance to win one of four **$25 Amazon Gift Cards,** courtesy of Wow! (Works on Wellness)!

Maine Medical Center
MaineHealth

Visit "Special Programs → Commuter Choice" on the MMC intranet site to register for Commuter Choice and learn more!

Questions? Contact CommuterChoice@mmc.org

"Bike to Work Day" materials



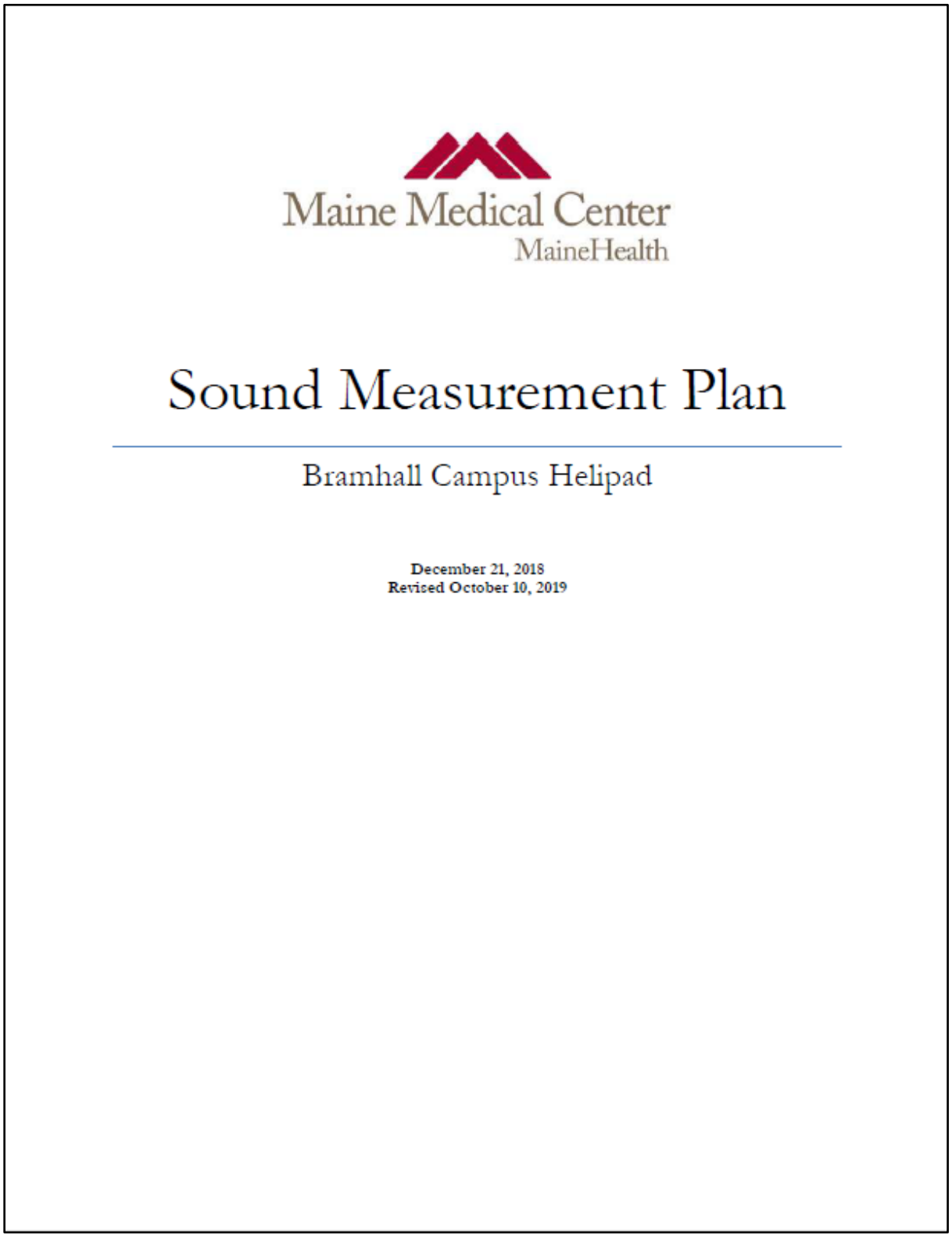
"Bike to Work Day" materials

Appendix D: Additional Strategies (Exhibits)

Bike Lockers

Bike Lockers were cleaned and serviced; additional keys were made (November 2018).

Appendix B: 2018 MMC Sound Management Plan



Appendix B: 2018 MMC Sound Management Plan

Contents

Appendix B: 2018 MMC Sound Management Plan

1. About this Plan

The purpose of this Sound Measurement Plan (SMP) is to fulfill a condition of approval for MMC's East Tower expansion project approved by the City of Portland Planning Board on March 27, 2018. The condition states:

> *That within nine months of the date of this site plan approval the applicant shall submit a "Sound Measurement Plan" for review and approval by the Planning Authority, for assessing the actual changes in sound impacts on nearby properties between the helipad operating at the existing site and at the new location, including criteria for mitigation where such impacts are severe based on appropriate national standards. The "Sound Measurement Plan" is required in the event that the predicted sound levels are incorrect, and it shall be approved and implemented at least two months before the helipad is relocated.*

This plan provides a brief history of air ambulance services at Maine Medical Center (MMC), describes the planned operations of the air ambulances at MMC in the future, and defines a noise compliant process related to air ambulance traffic at MMC.

MMC and regional air ambulance service providers are dedicated to providing high quality emergency and trauma healthcare services. MMC is the only level 1 trauma center in Maine and is the leading provider of complex medical care in Northern New England. Patients from every county in Maine and Carroll County, New Hampshire routinely come to MMC for health care services. When a serious accident occurs in Maine or a patient at another hospital needs care at MMC, an air ambulance is often used to transfer the patient. Time is critical when transferring patients to MMC for lifesaving care.

MMC recognizes that residents of the neighborhoods surrounding MMC are affected by noise from helipad operations. This plan seeks to provide a clear path forward for MMC and neighbors to better understand helipad operations.

The Federal Aviation Administration (FAA) is the authority over aircraft operations in the United States and provides guidance on projects that do not require a noise analysis. FAA 1050.1F Desk Reference Chapter 11 section 1.2 states:

> "…no noise analysis is needed for projects involving existing heliports or airports whose forecast helicopter operations in the period covered by the NEPA (FAA National Environmental Policy) document do not exceed 10 annual daily average operations with hover times not exceeding 2 minutes."

The forecasted helicopter operations is 750 flights annually or an average of 2.1 flights per day by 2022. Air ambulances at MMC do not have hover times exceeding 2 minutes. MMC wants to better understand its impact on the residents of the surrounding neighborhoods and is exceeding the expectations of the FAA for noise analysis for a helipad such as MMC's.

MMC's Institutional Development Plan, approved by the City of Portland Planning Board in November 2017, states:

> "MMC shall conduct a noise study as part of the site plan process if any change to the helipad are being proposed, and work to mitigate any potential noise impacts."

MMC completed a noise study during the site plan process that is further described in Section 4 of this document and is establishing plans to mitigate any potential noise impacts in this plan.

The following experts in hospital-helicopter operations and sound engineering were consulted in the creation of this SMP:

- Norman R. Dotti, P.E., P.P a Principal at Russel Acoustics, LLC, a nationally recognized sound and vibration-engineering firm.
- Thomas Judge, CCT-P, the Executive Director of LifeFlight of Maine.

More information on the qualifications of the consultants listed above is available in Appendix 1: Consultant Qualifications.

Appendix 2: The Basics of Noise and Sound provides a full definition of noise and sound as well as describes how sound is measured. It is included in this document to provide an education reference to anyone reading this plan.

2. Background of MMC Helipads

a. *History of Helipads at MMC*

In 2001, MMC began the planning and approval phase of adding a helipad to its facilities. Beginning operations in December 2007, MMC's helipad is used by LifeFlight of Maine to provide emergent, lifesaving access to emergency medical care for patients in Maine. Although MMC is Northern New England's only tertiary care hospital, it was the last of three top-level trauma centers in Maine to gain approval for the use of a helipad. Previously, critically ill patients flew to New Hampshire, Boston, or the Portland Jetport followed by an ambulance ride to MMC. A ground-ambulance ride in addition to an air-ambulance ride wastes valuable lifesaving time and is not considered best practice. The addition of a helipad addressed a longstanding unmet need for best practice air ambulance services of Maine's most critically ill patients.

The existing helipad was approved in 2005 as part of a contract zoning agreement between MMC and the City of Portland based on sound studies and assessment of potential impacts.

In 2018, the City of Portland approved MMC's Site Plan to relocate the helipad and vertically expand the East Tower and Visitor Garage subject to the condition requiring this document quoted in the above section. The approved helipad includes two landing pads. A primary pad that is larger and will be the most heavily used pad, and a secondary pad that is smaller and used when the primary pad is occupied. Please see Appendix 5: East Tower Helipad Design.

The benefits of the relocated helipad include:

- Immediate access to the Emergency Department. The former helipad, on top of the Gilman St. parking garage, required emergency staff to move laterally within the hospital before reaching the Emergency Department.
- Expanded capabilities to meet the growing need for emergency advanced care. The relocated helipad includes two landing zones that will provide unfettered access to lifesaving care at MMC.
- The number of flights per patient transported by air ambulance will decrease. The former pad, on top of the Gilman St. garage, required air ambulance pilots to relocate to the Portland Jetport if

another air ambulance arrived with a patient. Air ambulance pilots would have to return to MMC to pick up the air ambulance crew and the second air ambulance's pilot would have to repeat the same process creating 4 flights (2 incoming and 2 outgoing) per patient to the MMC helipad. The new design allows air ambulance pilots to land offload the crew and patient and power down until the air ambulance crew returns even if a second air ambulance arrives with a patient.

b. Operating the New Helipad on top of MMC's East Tower

The East Tower helipad has two landing locations, a primary and secondary pad. The primary pad is nearest to the parking garage. The location of the primary pad was chosen specifically to mitigate potential noise to the neighborhood adjacent to the East Tower. The primary pad will have the highest volume of flights. The secondary pad will be used in the event the primary pad is occupied. This can occur when two air ambulances are present. For example, if there is a car accident where more than one person needs to be air-lifted to emergency services, both air ambulances can have access to MMC's helipad without multiple flights. This can also happen when two patients need to be transferred to MMC from two hospitals at the same time. All flights to MMC's helipad are emergencies and there is no way to schedule flights or predict how frequently the secondary pad will be used. It is important to note that only one patient may be in an air ambulance at once. Please see Appendix 5: East Tower Helipad Design for a diagram of the East Tower helipad.

MMC requires any provider of helicopter emergency medical transport to operate in compliance with the Fly Neighborly Guide prepared by the Helicopter Association International Fly Neighborly Committee and published by the Helicopter Association International. Fly Neighborly is a voluntary noise reduction program that seeks to create better relationships between communities and helicopter operators by establishing noise mitigation techniques and increasing effective communication. The Fly Neighborly Guide encourages operational changes to minimize the potential noise impact of helicopter operations. This includes:

- Climbing turns are quieter than level and/or descending turns.
- Accelerating climbs are quieter than steady-state and/or decelerating climbs.
- Collective climb is quieter than cyclic climb.
- A higher altitude should be selected to reduce noise footprint.
- Turn away from the advancing blade.
- Steeper take-offs greatly reduce the noise footprint.
- A steep approach glidepath reduces the size of the noise footprint.
- Make smooth control inputs to reduce the noise footprint.
- Maximize steady state segments.
- Maintain the same airspeed during a turn.[1]

For more information about the Fly Neighborly Guide, visit - https://www.rotor.org/home.

Air ambulance providers that operate at MMC's helipad include LifeFlight of Maine, Boston MedFlight, and the Dartmouth-Hitchcock Advanced Response Team (DHART), and U.S. Coast Guard. The types of helicopters used by these emergency service providers include A109E, A109SP, EC135, H145, S76, and the U.S. Coast Guard's Jayhawk. The types of helicopters used at MMC's helipad may vary and are subject to change in the future. MMC and LifeFlight of Maine are committed to working with all air ambulance

[1] Fly Neighborly. Helicopter Association International. August 13, 2019. https://www.rotor.org/resources/operations/fly-neighborly2.

providers who may visit MMC's helipad to manage helipad utilization so as to minimize potential impacts to the neighborhoods surrounding MMC. MMC will share this plan with air ambulance providers and request that they adhere to it.

MMC and air ambulance providers, like LifeFlight of Maine, operate all day, every day of the year. Additionally, emergencies requiring air ambulance transport can happen at any time. Air ambulance services and emergency services are community benefits that MMC is committed to providing. Any efforts to limit the number of flights, the frequency of flights, or the time of day of flights are all methods of reducing potential noise impacts that will negatively impact patient care which is unacceptable.

The number of flights to MMC is directly related to the need for services at MMC. Northern New England states are the oldest states in the U.S. with Maine leading as the oldest with a median age of 44.6 years.[2] The use of healthcare services is highest among people 65 years or older. In addition, MMC is a provider of highly complex services offered nowhere else in Northern New England. As a result, MMC predicts the number of flights will increase over time. This prediction is based on the forecasted increase of the demand for healthcare services. The forecast considers the incidence and prevalence of disease, improvements in technology, and other factors impacting the demand for healthcare services.

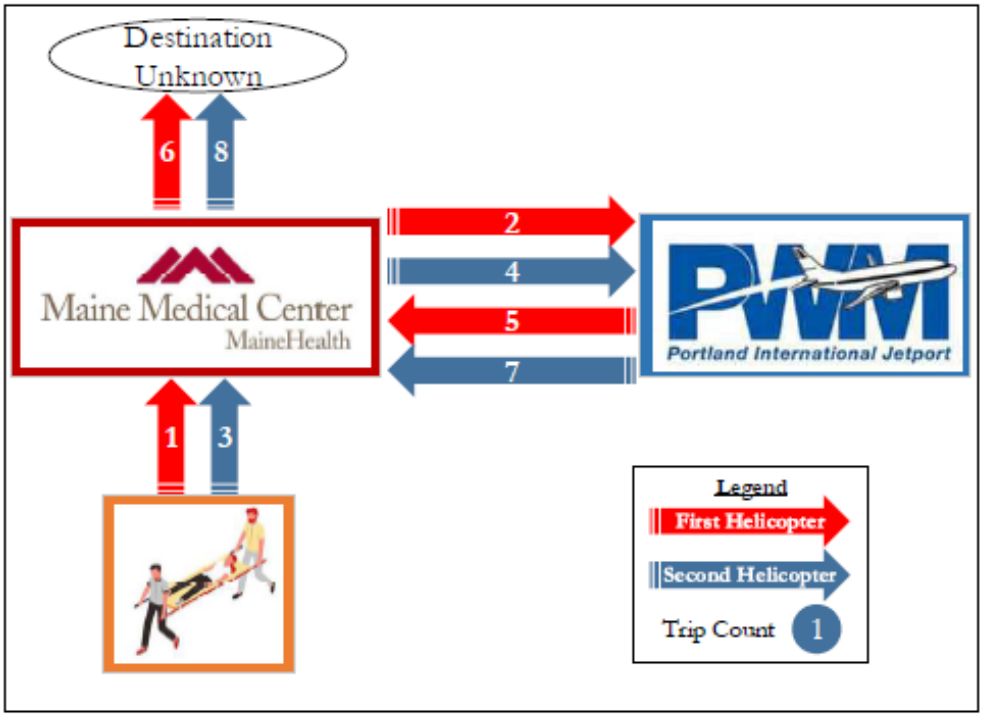
c. *Anticipated Growth*

Due to an increase in the need for highly complex care in the State of Maine, the number of flights is expected to increase in the coming years. However, due to the addition of a secondary pad, the number of flights per patient will decrease.

Today, with one helipad, approximately 2-3 times per month concurrent flights require access to MMC's helipad. With only one pad, the first patient must depart from MMC and relocate to the jetport after dropping off a patient, leaving behind its medical crew and equipment, and wait for the second aircraft to land and dispatch patients and crews. Once the second aircraft has departed to the jetport, the first aircraft flies back to MMC, picks up its crew and leaves. When two patient trips overlap, there can be as many as eight individual helicopter trips (four in-bound, four out-bound). As a result of these eight additional helicopter trips, unnecessary noise is created in surrounding neighborhoods, which could be a contributing factor in noise complaints. The addition of the secondary pad on top of the East Tower will reduce the number of flights per patient, therefore, reducing the potential sound impact on the neighborhoods.

[2] Northern New England States Still the Oldest. The Associated Press. September 14, 2018. https://www.usnews.com/news/best-states/maine/articles/2018-09-14/northern-new-england-states-still-the-oldest.

Figure 1 - Illustration of What Occurs When the Current Helipad on top of the Gilman Street Garage is Occupied and Another Helicopter Needs to Land.



MMC's recently approved project to replace the existing helipad and add another pad will reduce the number of individual flights generated by the helipad-to-jetport shuffling required in today's environment.

Figure 2 - Table of Estimated Flight and Trip Volumes 2018-2022 [3]

Year	Number of Flights Per Year (1)	Number of Helicopter Trips Per Year (2)
2018 (1 Helipad)	450	1,020 (3)
2022 (2 Helipads)	750	1,500
Net Change	300	480

(1) A flight includes both approach and departure.

(2) A Helicopter trip is defined as either an approach or departure.

[3] Figure 2 was produced using flight volumes previously supplied to the city in response to a request for a forecast by the city. MMC has no reliable way to forecast the volume of helicopter flights in the future. Air ambulances are used in the case of an emergency and emergencies cannot be reliably predicted.

(3) In 2018, there is only one (1) pad which means when the pad is occupied, a first helicopter must relocate to the jetport while the second helicopter unloads. Then the second helicopter must relocate to the jetport while the first helicopter picks up its crew. Then the second helicopter must return to pick up its crew. The result is an additional six (6) trips at MMC's helipad. (450 flights per year * 2 trips per flight = 900 Trips. Estimated number of times per month the situation above occurs (2-3 times or 2.5) * 4 additional trips * 12 months = 120. 900 trips per year + 120 additional trips back and forth to the jetport = 1,020 trips per year.)

3. Standards for Aircraft Sound

a. *National Standards*

Aircraft sound in the U.S. is governed by the Federal Aviation Administration (FAA). The metric used for assessing sound by them is the Day-Night Average Sound Level, abbreviated Ldn or DNL (the two terms are used interchangeably). Ldn/DNL is used by major Federal agencies (U.S. Environmental Protection Agency (EPA), U.S. Department of Housing and Urban Development (HUD), the U.S. Department of Energy (DOE), The U.S. Department of Defense (DOD), and others) and internationally in the assessment of potential noise impacts as a result of aerial vehicle operation (planes and helicopters). Additionally, the FAA regulates sound levels produced by all aircraft manufactured and certified for use in the U.S. to reduce potential noise impact on people to an acceptable limit before they even take flight. These regulations have produced quieter modern aircraft like those that currently use MMC's helipad and are considered industry standard.

A 2011 report for the Volpe National Transportation Systems Center (DOT/FAA/AEE/2011-03) stated "The Day-Night Average Sound Level, DNL, is the cornerstone of aviation noise impact analysis in the United States."

MASSPORT, the Massachusetts Port Authority, which administers multiple airports and other transportation venues in the state, defines the Day-Night Sound Level as follows:

> *Ldn: The Day-night Average Sound Level (Ldn) is the level of noise expressed (in decibels) as a 24-hour [logarithmic] average. Nighttime noise, between the hours of 10:00 p.m. and 7:00 a.m. is weighted; that is, given an additional 10 decibels to compensate for sleep interference and other disruptions caused by nighttime noise. An annual average of DNLs is used by the Federal Aviation Administration to describe airport noise exposure.*

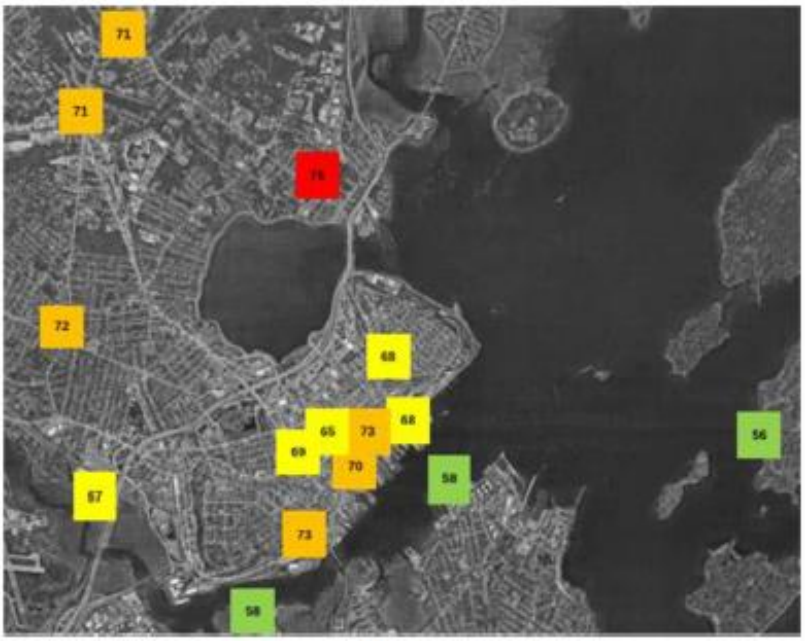
The aircraft-only DNL considers not only how loud a particular aircraft or helicopter event (landing or takeoff) is but also how long the sound is present, how many events occur over time, and whether the events occur during daytime or at night. The aircraft DNL is developed using computer modeling coupled with actual sound measurements of the various models of aircraft using a particular site and the facts of the pathways and frequency of aircraft flights.

The FAA defines noise sensitive areas in section 11-5.b.(10) as

> "(10) Noise Sensitive Area. An area where noise interferes with normal activities associated with its use. Normally, noise sensitive areas include residential, educational, health, and religious structures and sites, and parks, recreational areas, areas with wilderness characteristics, wildlife and waterfowl refuges, and cultural and historical sites."

It is important to note that aircraft DNL and a DNL of all sound in an area are different. The FAA does not provide guidance on an acceptable threshold for the DNL of all sound in a neighborhood. In a recent study commissioned by the City of Portland, DNL levels were calculated at locations around the City. The following figure provides the DNLs calculated by the study. The complete study is available at the City of Portland.

Figure 3 - Mean Measured DNL, Summer 2018



Source: Accentech Memo Dated January 4, 2019, Submitted to the City

As noted in the study, DNLs around the city are already above a DNL of 65 dB.

b. *Local Standards*

MMC is bound by Chapter 14 section 282 Maine Medical Center Institutional Overlay Zone Regulatory Framework which was approved by the Portland City Council in November 2017. Section (a) of 14-282 states

> *(a) Applicability. All development proposed by Maine Medical Center (MMC) within the boundary of the Institutional Overlay Zone (IOZ) shall be consistent with the approved Institutional Development Plan (IDP).*

consistent with the Comprehensive Plan, and meet applicable standards of the land use code, unless such standards are superseded by the following Regulatory Framework. This Regulatory Framework shall govern future development by MMC within the IOZ unless amended by the Portland City Council upon formal application of MMC.

The Institutional Development Plan for MMC was approved by the Portland City Planning Board in October 2017. This Sound Measurement Plan is consistent with the Noise Impact and Mitigating Impacts of the Helipad Operations sections of chapter four of MMC's IDP.

There are no other applicable local standards in the City of Portland.

4. Measuring Sound Generated by Helicopter Operations at MMC's Helipad

The aircraft DNL was determined through a combination of actual sound measurements collected as part of a sound study completed in 2017, sound test data from the FAA, and computer generated sound information.

The 2017 sound study was conducted by Russell Acoustics, LLC based in Point Pleasant, New Jersey. The sound measurements were collected over three calendar days at nine test locations (see Appendix 6: 2017 Sound Study Measurement Locations); from 12:00 to 12:00 (noon to noon) on 1 to 2 May 2017, and 14:00 to 15:00 on 2 and 3 May. The locations were chosen to reproduce the locations used in the 2003 report. The first set of measurements included ambient sounds only; there were no helicopter operations of any type during this period. Test flights were flown on the afternoon of 2 May, between 17:00 and 18:00. The flight tests were done within the one hour (i.e., not split across the on-the-hour times). The flight paths followed the FAA approved flight paths available in Appendix 3: Flight Paths. A recording of GPS (global positioning system) readouts from the test flight is available in Appendix 7: 2017 Flight Test Tracks. As indicated by the GPS readout, the flight test visited the existing garage helipad and the location of the proposed East Tower helipads. The aircraft landed on the existing pad and hovered over the location of the future pads during the flight test.

During the site plan review, MMC provided the City with a memo, dated February 2, 2018, describing the change in sound per sound measurement location to quantify the difference in sound between the garage pad and the East Tower pad. The summary tables from that memo are included in Appendix 4: Sound Measurement Summary Tables. These tables discuss the difference in terms of ambient sound and sound during the flight test. There is no national standard to compare these measurements to.

Determining the aircraft DNL is the best possible measure for determining sound generated by MMC's helipad. It is a measurement used by the FAA and airports across the U.S. as discussed in section 3.a. It isolates sound generated by helicopters using the helipad and it does not account for other sounds in the neighborhood. In order to determine the aircraft DNL, the following factors and assumptions were considered.

- Sound data collected during the 2017 sound study.
- The average sound of the varying types of helicopters that use MMC's helipad previously mentioned from the FAA. Sound data from the FAA is conservative because of the way the FAA conducts its

sound recordings – the approach and departure slope is much shallower than typical practice which results in a noisier flight from the perspective of someone standing on the ground.[5]

- The frequency of visits from each type of helicopter. In order to estimate future DNL, MMC assumed two (2) flights per day or 730[6] flights per year.
- The time of day helicopters are flown. MMC assumed two flights per twenty-four (24) hour period – one during the day and one at night. The FAA defines nighttime as between 10:00 PM - 7:00 AM. Night time flights are penalized by adding 10 dBA.
- The flight "patterns" used by pilots arriving and departing from MMC's helipad. Pilots are generally coming straight into the helipad descending from a cruising altitude rather than arriving over the helipad and descending straight down from cruising altitude. This is to minimize the amount of sound exposure to the residents of neighborhoods surrounding MMC.
- The height of the helipad (134' above grade).

The projected aircraft DNL generated by MMC's helipad is 65 at the foot of the East Tower, on which the helipad sits. Because sound dissipates as distance increases, the projected DNL is 61.7 at two hundred (200) feet from the foot of the building.

a. Sound Measurement Locations

There is no "standard" or formula for selecting sound measurement locations for these evaluations. The principal concern is what residents hear, day and night, in the vicinity of helicopter operations into and out of the hospital. In previous sound studies several monitors were located close to the hospital and the rest spread further out into the community to bracket a good range of residences. For the sound measurement locations of the 2017 study, please see Appendix 6: 2017 Sound Study Measurement Locations.

b. Comparison of Historic Data is Challenging

Comparisons between sound studies done at different times (times of day, time of the week, months during the year) is challenging due to the impact of meteorological factors as well and other environmental factors such as the presence of other sound generators contributing to Portland neighborhoods' ambient sound levels. Previous sound studies at MMC have demonstrated a universal increase in ambient sound levels. However, with the assistance of Sound Engineering consultants, MMC will provide comparisons of the data from this study to historical studies with the stipulation that a true comparison is impossible to provide given the variable changes that occur.

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[5] A comparison between the maximum sound energy (Lmax) recorded by the FAA for the A109 model helicopter (the most common helicopter used by LifeFlight of Maine) and the maximum sound energy recorded by a sound study completed by MMC in 2017 is available in Appendix 8: LMax dBA Comparison. The maximum sound energy recorded by the FAA and the 2017 sound study are similar. As a result, the use of FAA data in DNL calculations was considered to be valid.

[6] MMC estimates the total number of flights per year will increase to 750 per year by 2022. That is roughly 2.1 flights per day in 2022. MMC's estimate used 730 flights in order to evenly account for one daytime flight and one nighttime flight per 24 hour period. This is important because nighttime flights are penalized by 10 dBLs.

5. Complaints and Monitoring

MMC will reestablish its phone hotline for neighborhood complaints and will, working with the City of Portland Planning Department, address appropriate neighborhood sound issues. The number to call with complaints about MMC's Helipad is:

MMC Helipad Complaint Hotline: 207-662-4880.

a. General Complaints Process

Callers will be asked to leave their name, contact information, the day, the time, and the details of the compliant via voicemail. MMC will confirm receipt of complaints by communicating directly with the individual who filed the complaint. Complaints will be recorded and shared upon request and shared with LifeFlight of Maine.

If ten (10) complaints are filed by property owners or residents about a single flight, MMC will work with emergency air transportation providers to complete a retroactive review of the flight's path and log whether an exception occurred. The review will be summarized in a report that will be shared with the MMC's Neighborhood Advisory Committee. If a pattern of non-compliance[7] is identified, MMC will reevaluate the approved flight paths to determine whether a new flight path is needed or if helicopter operations guidelines are not being followed.

If a new path is needed, MMC will pursue the appropriate review and approval process with the FAA. If a new flight path is approved, MMC will reevaluate the list of properties eligible for mitigation using the same methodology as described below.

If helicopter operations guidelines are not being followed, MMC will work with air ambulance providers to understand the reasons for non-compliance and seek methods to improve compliance with guidelines.

b. Properties Potentially Impacted and Eligible for Mitigation

If after 6 months of operations twenty (20) complaints are filed within a contiguous six (6) months by property owners of properties listed below, MMC will recalculate aircraft DNL to determine if the significance threshold as defined by the FAA and provided in section 3.a has been reached. Aircraft DNL will be recalculated based on measured data at intervals most appropriate for calculating DNL within six (6) months of reaching the complaint threshold.

14 CFR Part 150 Appendix A from the FAA establishes the basis for determining noise exposure maps[8][9]. It says that a sound contour for 65 DNL should be identified on a noise exposure map. As previously stated, 65 DNL is the FAA threshold for noise impact. Appendix A reaffirms this by listing residential, public use,

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[7] A pattern of non-compliance is defined as thirty-three percent (33%) of total flights using an alternative route within a contiguous six (6) months.

[8] FAA 14 CFR part 150 Appendix A

[9] Appendix A also offers the following guidance to local governments: *"(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems."*

commercial use, manufacturing and production, and recreational use as compatible with a DNL below 65. Therefore, properties within the 65 DNL sound contour would be eligible for mitigation.

As discussed in section 4, projected DNL from the helipads is 65 at the foot of the East Tower. Aircraft DNL at all points farther from the East Tower, as modeled, is less than 65. Therefore, no properties are eligible for mitigation at present. However, MMC understands that sound impacts are subjective and perceived differently by different individuals. In order to identify properties that could potentially fall into the 65 DNL contour and be eligible at some future point, MMC mapped properties within four hundred (400) feet of MMC's helipads.

If the recalculated aircraft DNL demonstrates that the FAA threshold has been met, the following properties will be eligible for mitigation measures if they are within a 65 DNL contour.

Figure 4 - Map of Distance Contours from MMC's Helipad[10]

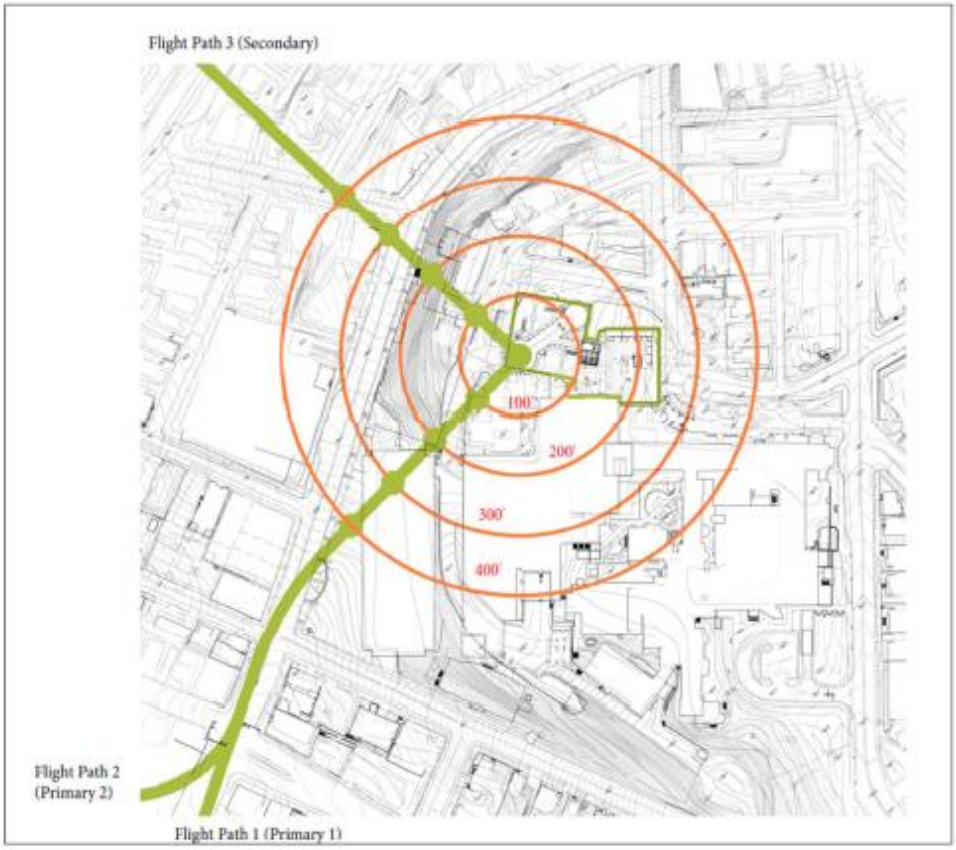


Figure 5 - Properties within 400' of MMC's East Tower Helipad

Address	CBL #	Address	CBL #
40 Ellsworth	054 C010001	5 Crescent St	053 F009001
15 Russell St	054 C012001	9 Crescent St	053 F007001
11 Russell St	054 C009001	15 Crescent St	053 F006001
9 Russell St	054 C008001	19 Crescent St	053 E008001
7 Russell St	054 C007001	25 Crescent St	053 E003001
14 Hill St	054 C003001	832 Congress St	053 F001001
18 Hill St	054 C002004	852 Congress St	053 E007001
20 Hill St	054 C001001	867 Congress St	053 I021001

[10] MMC's primary helipad is used as the apex for these distances contours because the majority of flight will be landing on this pad. The secondary pad will only be used in the event that the first pad is occupied.

32 Ellsworth St	054 C005001	871 Congress St	053 I020001
34 Ellsworth	054 C006001	873 Congress St	053 I017001
19 Hill St	054 B002001	879 Congress St	053 I016001
17 Hill St	054 B004001	8 Weymouth St	053 I019001
25 Ellsworth St	053 H002001	12 Weymouth St	053 I011001
23 Ellsworth St	053 H003001	8 Boynton St	053 I009001
19 Ellsworth St	053 H004001	12 Boynton St	053 I008001
2 Crescent St	053 H005001	863 Congress St	053 C015001
9 Wescott St	053 H001001	861 Congress St	053 C016001
3 Crescent St	053 F008001	5 Weymouth	053 C001001

c. Mitigation Measures

The FAA 1050.1F Desk Reference Chapter 11 section 6 lists potential mitigation measures related to noise and noise-compatible land use that include:

- Acquisition of land or land interests, including air rights, easements, and development rights, to ensure the use of property for purposes compatible with noise exposure;
- Sound insulation of residences and other noise sensitive structures; and
- Construction of noise barriers or acoustic shielding to mitigate ground-level noise.

The above mentioned mitigation measures will be explored by MMC and the property owner(s) if the FAA threshold is reached and the property owners request mitigation action. For owners to qualify for mitigation, the aircraft DNL must exceed the FAA threshold triggering mitigation. The manner of mitigation, should it be deemed necessary, shall be made in consultation with property owners and determined by MMC.

d. Long-Term Monitoring

MMC will conduct a sound study every three years following the opening of the helipad but no sooner than three years if a sound study is completed based on the complaint criteria above. Future sound studies will account for the number of flights and flight paths used at the time of the study. Future sound studies will use the same sound measurement locations and method for calculating aircraft DNL. Future sound studies will capture sound in 1 second intervals, which is best for calculating DNL.

If there is a change to the approved flight paths, MMC will reevaluate the list of properties eligible for mitigation using the same methodology as described in above in section 5.b. Any properties then added to the list of eligible properties will be eligible for mitigation as described above in section 5.c.

If the FAA threshold is met, the properties listed in Figure 5 above will be eligible for mitigation measures listed in section 5.c.

e. Conclusion

This revised Sound Measurement Plan provides guidance for measuring sound generated by MMC's helipad and future determination of sound mitigation and changes in helicopter operations.

This plan meets the requirements established in a condition of approval for MMC's East Tower expansion project approved by the City of Portland Planning Board on March 27, 2018.

Once approved by the City, this plan will be presented by MMC to the Neighborhood Advisory Committee. The purpose of the presentation to the Neighborhood Advisory Committee is to inform the members of the committee of the details of this plan so that they may share it with others in their neighborhoods.

Appendix B: 2018 MMC Sound Management Plan

Appendix

Appendix 1: Consultant Qualifications

NORMAN R. DOTTI, P. E., P. P.

Principal

Mr. Dotti is a graduate Mechanical Engineer, a Registered Professional Engineer, and a Licensed Professional Planner. As a practicing Acoustical Engineer since 1971, he has over 30 years of direct experience with sound and vibration measurement, analysis, control and engineering project management. He has applied over two decades of electronics, instrumentation and computer programming experience to designing and supplying systems and software for sound and vibration measurement and analysis.

As part of his work he has: conducted hundreds of on-site studies of environmental, architectural and industrial sound and vibration problems; started, developed and managed a group of consulting engineers specializing in noise and vibration control; testified as an expert witness in planning hearings and local, State and Federal courts; worked with experts in other fields on large engineering and architectural projects to integrate sound and vibration controls; designed, programmed and built automated sound and vibration measurement systems for environmental and industrial clients; worked with clients from industry, all levels of government, associations, military, as well as private individuals and community groups.

Professional Experience

- 2005 - Present
  Principal, Russell Acoustics, LLC. Consulting engineering services pertaining to sound and vibration measurement, analysis and control.
- 1987 - 2004
  President, Knorr Associates. Acoustical consulting and management of environment, health and safety information management systems development. Responsible for all company technical and business operations. This includes proposal development, field and laboratory studies, analysis and design, report writing, and testimony.
- 1979 - 1987
  Vice President, Ostergaard Associates. Planned, proposed, managed and conducted architectural, environmental and industrial sound and vibration studies for client projects. Developed field instrumentation for long-term environmental monitoring projects. Planned and managed corporate computer system for word processing and data collection and analysis, including spectrum analyzer interfaces and computer graphics. Testified as an expert witness in acoustics for planning boards and in courts to the Federal level.
- 1971 - 1979
  Manager, Noise & Vibration Services, National Loss Control Service Corporation (NATLSCO). Proposed, started and managed sound and vibration (S&V) consulting group within large multi-national consulting firm. Developed computerized sound lab and company multi-user computer system for engineering. Work included performing and managing S&V projects for environmental, architectural and industrial clients, including finite element analysis of power plant and submarine systems. Developed and taught training courses for Bruel & Kjaer Instruments (INC I & II) and the OSHA Training Institute.
- 1968 - 1971
  Pilot, U. S. Air Force. U.S.A.F. pilot training, AC-119K combat crew pilot. Holds a Commercial Pilot license with Multi-engine and Instrument ratings.
- 1965 - 1968
  Research Engineer, Underwater Weapons Division, Davidson Laboratory. Computer analysis and modeling of high performance underwater vehicles; DSRV submarine rescue vehicle, Polaris missile,

MK-48 torpedo, DENISON hydrofoil boat. Performed original research in the mathematics of modeling complex stability and control systems on digital computers.

Education

- Bachelor's degree: Stevens Institute of Technology, Bachelor of Engineering degree, 1968. Machine design, stability and control, computer programming.
- Master's degree: New Jersey Institute of Technology, School of Management, Master of Business Administration (MBA) in Management of Technology, 2003

Specialized Postgraduate Courses

- Fifth Institute of Noise Control Engineering Industrial Noise Control (B&K)
- Designing Quiet Products (B&K) Microphones & Accelerometers (B&K)
- Acoustic Materials & Structures (B&K) Designing Digital Filters
- Applied Time Series Analysis (GenRad) Acoustic Modeling (MIT)
- Industrial Hygiene Engineering Industrial Hygiene Toxicology
- Reading Speech Spectrograms (MIT)

Professional Licenses

- Licensed Professional Engineer, New Jersey and Illinois
- Licensed Professional Planner, New Jersey
- Professional Associations, Societies & Memberships
- Acoustical Society of America
- Audio Engineering Society
- Institute of Noise Control Engineers
- American Industrial Hygiene Association - Noise Committee
- Air Pollution Control Association - TP6 Noise Committee
- Illinois Manufacturers Association Noise Advisory Committee - Chairman
- National Council of Acoustical Consultants representative to American National Standards Institute S3 Committee on Bio-acoustics
- New Jersey Noise Control Regulation Task Force
- Research Fellow of the Research and Development Staff of Metrosonics, Inc.

Teaching

Mr. Dotti has developed courses for and taught at the U.S. Department of Labor's OSHA Training Institute, Des Plaines, IL, for over ten years. His Advanced Noise Control course has been presented to hundreds of OSHA industrial hygienists and safety compliance officers, military personnel, Coast Guard and Postal Service employees and labor and industry representatives.
He also developed the course notes for and taught week-long sound and vibration measurement and control seminars for Bruel & Kjaer Instruments. The Industrial Noise Control I and II courses were taught over a period of six years.

The above courses and custom classes have been prepared for and taught to Federal, State and local government agencies, including the U. S. Navy and the States of Virginia, Kentucky and South Carolina. Classes in sound and vibration measurement and control for industry have been presented to companies including IBM, Borg-Warner and several workers' compensation insurance carriers.
Mr. Dotti was an Adjunct Professor for several years at Montclair State College, where he taught courses in numerical analysis and computer programming.

Representative Projects
Mr. Dotti has managed many of the following projects and has actively participated in the planning, measurement and engineering of all of them:

Environmental Sound
Custom design, construction and installation of computer controlled community noise monitoring systems for industrial plants and other community sources | Test and design of muffler and barrier systems for manufacturing plant fan, process and stand-by equipment noise control | Solid waste transfer station testing and analysis for engineering noise control and permitting | Computer programming for acoustical evaluation of S&V engineering alternatives | Helicopter and fixed wing aircraft sound assessment, measurement and regulation development | Truck and other motor vehicle drive-by tests, road-side barrier design | Long-term measurement of community sound levels and variations, including HUD surveys | Site development community and traffic noise surveys for zoning and planning review | Measurement of interior sound levels from outside sources and acoustical design review of construction details | Property line measurements for regulation compliance

Industrial Sound
Employee noise exposure and OSHA surveys | Engineering noise control measurement and design | Hearing conservation and audiometric testing programs | Computerized noise exposure and audiometric test data analysis | Machinery noise source identification and control | Employee education programs and manuals | Sound level contour mapping.

Architectural Sound
Recording and broadcast studio building and ventilation design | Office sound isolation materials selection and ventilation system (HVAC) modeling and modifications | Conference and classroom voice articulation | Electronic paging and voice re-enforcement systems | Isolation of exterior noise sources; traffic, aircraft, music, manufacturing | Apartment, town house and other residential sound isolation | Identification of exterior noise sources.

Vibration
Finite element analysis of nuclear power plant components for earthquake response | Structure-borne noise generation measurements and analysis of Navy shipboard power supplies and Trident submarine trailing SONAR array | Air conditioning chiller pipe and floor vibration isolation design and test | PATH Journal Square Transportation Center building and cooling tower vibration tests | Semiconductor manufacturing and clean room equipment vibration isolation | Impact isolation of power press and general manufacturing equipment | Measurement and prediction of human response to ground-borne and building vibration | Design and programming of maintenance vibration monitoring systems.

Forensic Acoustics
Expert witness testimony and litigation support | Measurements to determine compliance with local, State and Federal regulations | Expert report review | Identification of contributing sound and vibration sources | Regulation review and development | Enhancement and recovery of tape-recorded conversations | Tape authentication | Speech analysis and speaker identification | Measurement and analysis of live and recorded voice intelligibility and comprehension | Physiological and psychological response to sound and vibration | Testing of "cordless" telephone in-ear sound levels | Measurement of sound and vibration levels and frequency for determining human detectability and annoyance | Pre- and post-construction building site ambient levels measurement and design of mitigation measures | Re-zoning application surveys | Heliport and helistop sound level assessment | Gunshot measurement and analysis; hearing damage.

Personal Background
Mr. Dotti enjoys teaching and is active in community affairs; he has served as a Captain in his community's volunteer fire department and has been a member for over 25 years.

Thomas Judge, CCT-P
Executive Director, LifeFlight of Maine

Tom Judge serves as the Executive Director of LifeFlight of Maine, a non-profit hospital-based helicopter critical care system serving the entire state of Maine. He also serves as Executive Director of the LifeFlight Foundation, a non-profit charitable organization that funds aviation infrastructure and outreach education services to hospital and EMS providers. LifeFlight has been nationally recognized for quality, safety and innovative excellence in community service.

Tom brings thirty years of experience in pre-hospital emergency medical services to these organizations, in roles ranging from provider to system planner. He currently serves on the board of the Foundation for Airmedical Research and Education and is a past president of the board of the Association of Air Medical Services. In 2009, he was appointed to the National EMS Advisory Council where he provides advice and recommendations on matters relating to all aspects of the development and implementation of EMS. He also is a consultant for an international accreditation group, serves on the faculty of the annual conference of the National Association of EMS Physicians and on the editorial board of the Emergency Medicine Journal. Locally, he serves as a trustee for Penobscot Bay Healthcare in Rockport and is an active paramedic for the St. George Volunteer Firefighters and Ambulance Association.

In the mid-1990s, Tom spent a year in the United Kingdom as an Atlantic Fellow in Public Policy, during which time he studied at the Medical Care Research Unit, the University of Sheffield and with the Scottish Ambulance Service. He is particularly interested in the effects of healthcare policy and the issues of access and equity in the provision of rural medical care.

Tom has written dozens of articles for emergency and air medical journals and made several presentations at international EMS conferences around the world including South Africa, London, the Czech Republic, Vancouver, Japan, Paris, Spain, Scotland and across the United States.

Appendix 2: The Basics of Noise and Sound

There are many factors that impact noise and sound.

Noise

Noise can be defined as any unwanted sound. What sounds may annoy someone may or may not annoy others. In addition, what sounds annoy an individual can vary, depending on the situation.[11]

Here are some things that affect an individual's level of annoyance:

- Time of Day - For example, you may be more upset by noise heard at night while you are trying to sleep or relax, than from the same noise heard during a busy day at work. Noise at night may also be more noticeable because the background noise level is lower than during the daytime.
- Length of Time - The longer you are exposed to a noise, the more it may annoy you.
- Predictability - If you cannot predict when the noise will occur, it may annoy you.
- Control - If you have little control over the noise, it may annoy you.
- Emotional Variables - Emotional noise variables are those that cause differences in your perception of a noise. It depends on your experiences, values, beliefs, and mood. If you believe that a noise is unnecessary or unimportant, you may be more annoyed by the noise. For example, if you were awakened by noise from an airplane that you believed was transporting tourists, you could be irritated. On the other hand, if you knew the airplane was transporting goods such as food, medicine, mail, and other perishable necessities, you may be more willing to tolerate the disturbance.
- Physical Surroundings - Surroundings such as snow, grass, trees, and other vegetation can help alleviate noise by reducing the sound through absorption or deflection of sound waves. However, during the summer months, open windows and more time spent outside may result in more noise exposure.

Sound

Sound is all around us; sound becomes noise when it interferes with normal activities, such as sleep or conversation.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (e.g., music) or unpleasant (e.g., jackhammers) depends largely on the listener's current activity, past experience, and attitude toward the source of that sound.

The measurement and human perception of sound involves three basic physical characteristics: intensity, frequency, and duration. First, intensity is a measure of the acoustic energy of the sound vibrations and is expressed in terms of sound pressure. The greater the sound pressure, the more energy carried by the sound and the louder the perception of that sound. The second important physical characteristic of sound is frequency, which is the number of times per second the air vibrates or oscillates. Low-frequency sounds are

[11] Noise Basics, Noisequest.psu.edu, 2018

characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches. The third important characteristic of sound is duration or the length of time the sound can be detected.[12]

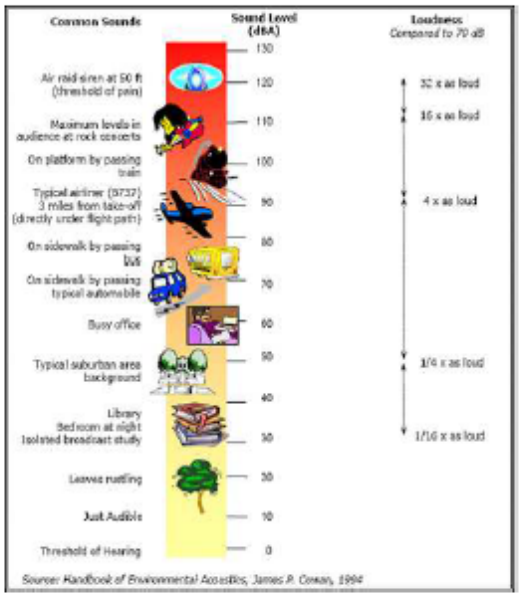
Distance from whatever is generating sound also has an impact. Distance can be horizontal or vertical. For example, two people speaking at a distance of three feet can be heard and likely understood while two people talking 100 feet away may be barely audible.

How is Sound Measured?

Sound intensity or level is measured by decibels.

The loudest sounds that can be detected comfortably by the human ear have intensities that are a trillion times higher than those of sounds that can barely be detected. Because of this vast range, using a linear scale to represent the intensity of sound becomes very unwieldy. As a result, a logarithmic unit known as the decibel (abbreviated dB) is used to represent the intensity of a sound. Such a representation is called a sound level. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB; sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 to 140 dB are felt as pain (Berglund and Lindvall 1995).[13]

Figure 6 - Comparative Sound Levels



[12] Noise Basics - Basics of Sound, Noisequest.psu.edu, 2018. For more on the basics of sound, please see the Science of Sound video produced by NASA at https://youtu.be/_ovMh2A3P5k.
[13] Noise Basics – Basics of Sound, How is Sound Measured?, Noisequest.psu.edu, 2018.

Appendix 3: Flight Paths

Fig.4.5 Proposed Flight Routes for the new MMC Helipad

NOTE: Path #3 is new and will only be used under high wind conditions if required by the Federal Aviation Administration.

Appendix 4: Sound Measurement Summary Tables

Table 2 Replicate

Position	Ambient Range	Ambient Average	5-Second Leq Flight Test Range	Flight Test Average	Sound Level Change of Averages	Arrive & Depart
CP1	83-84.1	83.5	78.1-77.3	78.7	-6.8	72.4, 65.7
CP2	92-94.1	93	85.8-88.2	87.5	-5.5	88.6,83
CP3	86.1-99	91.3	95.1-97.2	96.2	4.7	78.7, 81
CP4	78.1-81.5	79.8	88.3-89.6	89	9.2	65.2, 70.6
CP5	84.6-92	88.3	65.8-66.8	66.2	-22.1	64.2, 55.5
CP6	76.3-82.9	79.3	71.1-73	72.4	-6.9	65.5, 67.5
CP7	77.8-85.4	80.6	84.7-87.7	86.2	5.6	71.2, 88.1
CP8	85.2-91.9	88.5	58.7-68.1	63.4	-25.1	65.2, 52.6
CP9	89.9-94.8	92.4	68.8-71.1	70	-22.4	77.3, 67.5

Table 3 Replicate

Position	Ambient Range	Ambient Average	1-Minute Leq Flight Test Range	Flight Test Average	Sound Level Change of Averages	Arrive & Depart
CP1	75.2-76.1	75.7	69.4-71.2	70.3	-5.4	66.8, 58.9
CP2	82.2-84.4	83.3	82.8-86.4	84.6	1.5	83.8, 77.8
CP3	75.7-76.3	76	88-90.1	89	13	78.4, 74.3
CP4	71-74.1	72.6	79.3-82.7	81.1	8.5	98.8, 61.9
CP5	75.6-83.3	79.4	56.8-58.8	57.8	-21.6	58.6, 49.1
CP6	70.4-75.2	72.8	64.5-67.3	65.9	-6.9	62.8, 59.6
CP7	70.5-75.6	73	76.8-82.7	81.2	8.2	67.5, 74.3
CP8	76-83.3	80.6	55.4-62	58.7	-21.9	55.4, 50.2
CP9	81.5-88	84.8	62.6-64.6	63.6	-21.2	67.1, 61.1

Table 2 and Table 3 were extracted from a February 2, 2018 memo from Russell Acoustics, LLC to MMC's Manager of Facility Development that was submitted to the City of Portland as part of the East Tower & Visitor Garage site plan review process.

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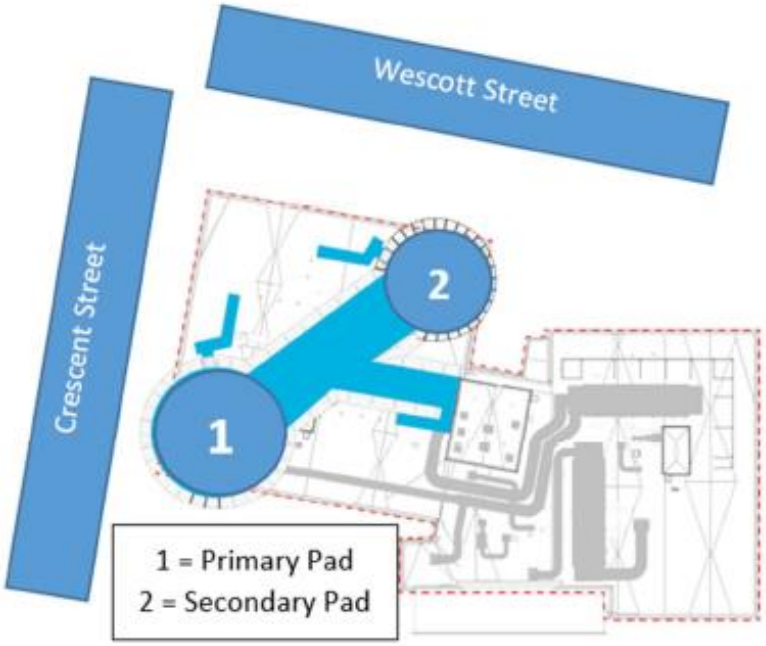
Appendix 5: East Tower Helipad Design



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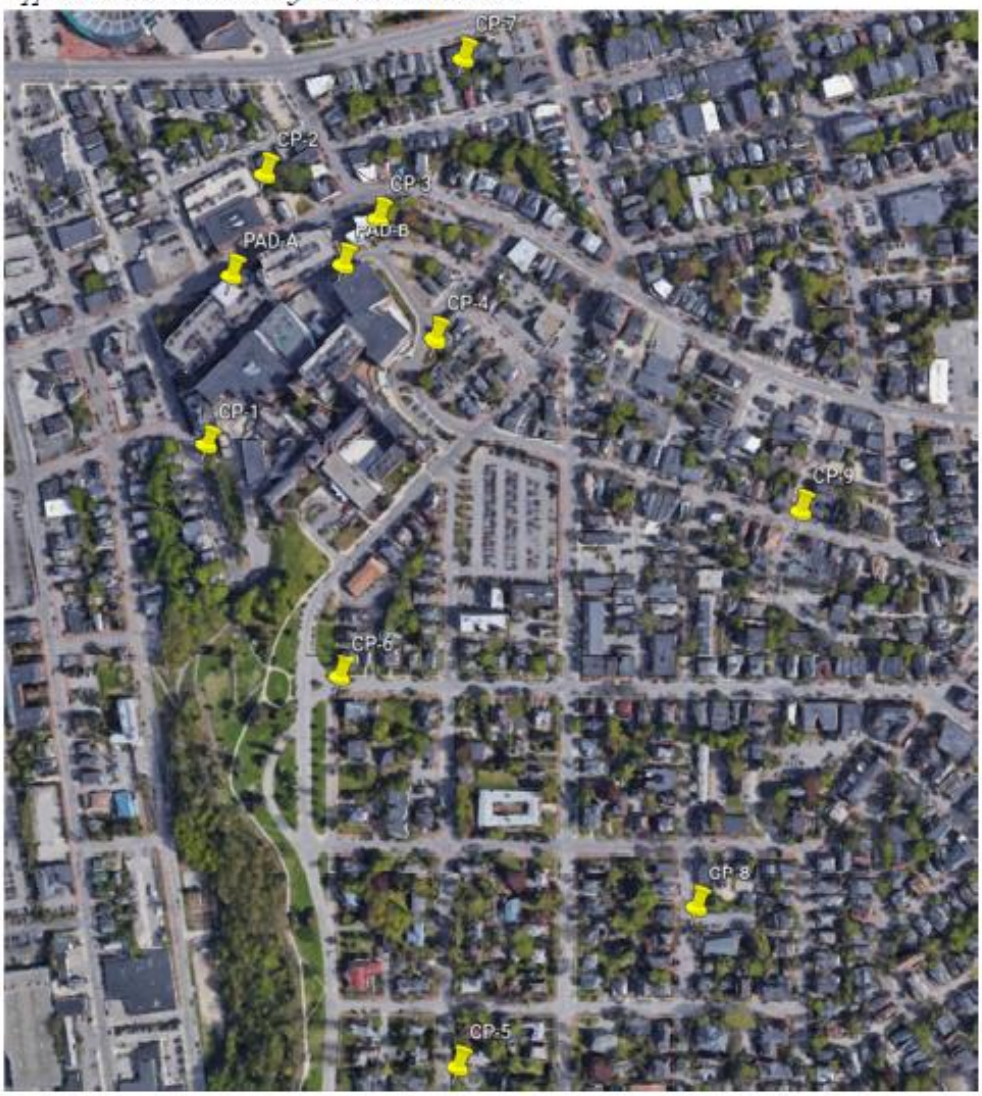
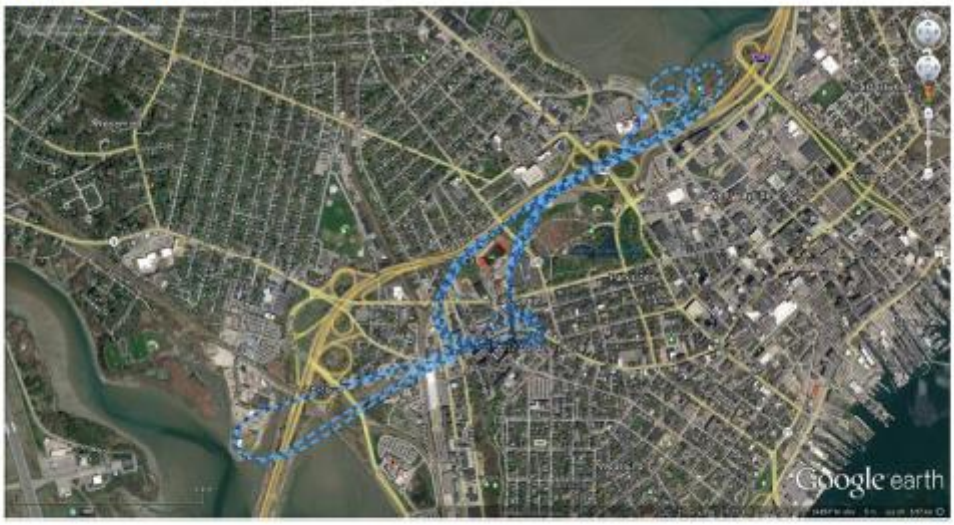
Appendix B: 2018 MMC Sound Management Plan

Appendix 6: 2017 Sound Study Measurement Locations



Appendix 7: 2017 Flight Test Tracks

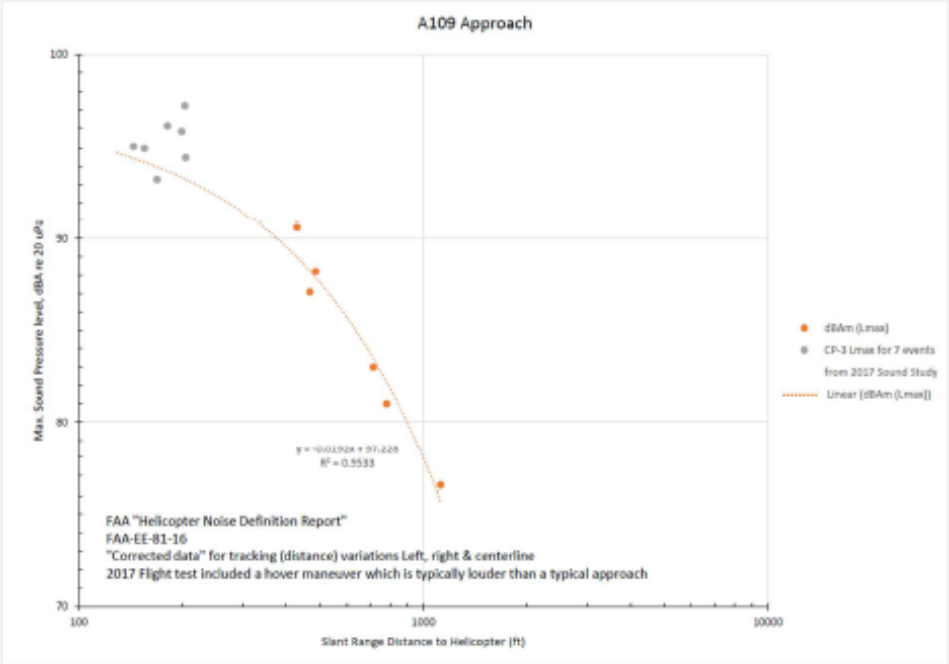
From on-board GPS.



Appendix 8: LMax dBA Comparison

The following graphs show the maximum sound energy generated by an A109 aircraft – the most commonly used aircraft used by LifeFlight. The FAA data is collected using a typical arrival, landing, and departure. The test flight completed during the 2017 sound study did not include a landing. Instead, the helicopter hovered which is a, generally speaking, louder event than a landing.

FAA Graph 1: Aircraft Approach



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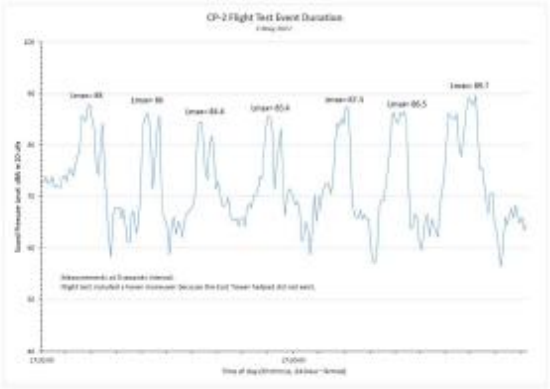
2017 Sound Study Graph 1: Sound Measurement Location CP2



2017 Sound Study Graph 2: Sound Measurement Location CP3