MDOT
Michigan Department of Transportation

Michigan Department of Transportation

Multimodal Airport Charging Station Deployment—Phase 1

August 29, 2024

C&S Engineers, Inc.
38777 Six Mile Rd. Suite 202
Livonia, MI 48152
www.cscos.com

C&S COMPANIES®

This page has been intentionally left blank.

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. **SPR-1742**	2. Government Accession No. N/A	3. Recipient's Catalog No. N/A
4. Title and Subtitle Multimodal Airport Charging Station Deployment – Phase I		5. Report Date August 2024 6. Performing Organization Code N/A
7. Author(s) John Trendowski, PE Kelly Jost, PE Mia Held Matthew LaRue, PE Corey Johnson Basil Yap Chris Fernando Bhoomin Chauhan		8. Performing Organization Report No. N/A
9. Performing Organization Name and Address C&S Engineers, Incorporated 38777 Six Mile Road, Suite 202 Livonia, Michigan 48152		10. Work Unit No. N/A 11. Contract or Grant No. Contract 2023-0205
12. Sponsoring Agency Name and Address Michigan Department of Transportation (MDOT) Research Administration 8885 Ricks Road P.O. Box 33049 Lansing, Michigan 48909		13. Type of Report and Period Covered Final Report, 4/3/2023 – 8/31/2024 14. Sponsoring Agency Code N/A

15. Supplementary Notes

Conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration. MDOT research reports are available at www.michigan.gov/mdotresearch.

The report is based upon work supported by the MDOT and Federal Highway Administration under SPR 1742. Any opinions, findings and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the Federal Highway Administration."

16. Abstract

The Multimodal Airport Charging Station Deployment – Phase I research addressed the following principal objectives:

- Conduct a feasibility analysis for a multimodal charging station at a Michigan Airport.
- Provide recommendations on design and implementation of multimodal charging stations.

The research team reviewed previous reports, evaluated available charging and metering systems, and electric aircraft. In order to determine the most feasible airport for the initial multimodal charging station, the team assessed and ranked Tier 1 and Tier 2 airports within the State of Michigan by utilizing publicly available data and survey responses regarding their existing infrastructure and interest in hosting a multimodal charging system. From this initial analysis, six airports were short-listed for further analysis, including three General Aviation (GA) airports, two primary non-hub airports, and one primary small hub airport. From this short-list, site visits and further evaluations were conducted to recommend an initial airport for multimodal charging station. The research included concept design and an opinion of probable cost for charging infrastructure which could charge two electric aircraft and four passenger vehicles simultaneously. The concept design could be scalable, but final design is airport specific based on-site conditions and project requirements. Airports interested in a multimodal charging station should continue to investigate available technology, regulatory requirements, and funding opportunities.

17. Key Words	**18. Distribution Statement**
Airport multimodal charging stations, electric aircraft, electrification funding	No restrictions. This document is also available to the public through the Michigan Department of Transportation.

19. Security Classif. (of this report)	**20. Security Classif. (of this page)**	**21. No. of Pages**	**22. Price**
Unclassified	Unclassified	250 (including back of cover and document)	N/A

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Acknowledgements

The C&S Engineers, Inc. research team would like to acknowledge the Michigan Department of Transportation (MDOT) for their sponsorship, cooperation, and support in this project. We are grateful to the MDOT team for arranging and participating in progress meetings, reviewing draft deliverables, and providing input throughout the project. In addition, the research team would like to thank the Department Michigan of Environment, Great Lakes, and Energy (EGLE) as well as electric charger, metering, and electric aircraft companies who attended meetings and provided information in the development of this report.

Disclaimer

This publication is disseminated in the interest of information exchange. The Michigan Department of Transportation (hereinafter referred to as MDOT) expressly disclaims any liability, of any kind, or for any reason, that might otherwise arise out of any use of this publication or the information or data provided in the publication. MDOT further disclaims any responsibility for typographical errors or accuracy of the information provided or contained within this information. MDOT makes no warranties or representations whatsoever regarding the quality, content, completeness, suitability, adequacy, sequence, accuracy or timeliness of the information and data provided, or that the contents represent standards, specifications, or regulations.

This material is based upon work supported by the Federal Highway Administration under SPR-1742. Any opinions, findings and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the Federal Highway Administration.

Interactive Report

Click on a title below to go to that section.

Click on the icon on any page to return to the table of contents.

Table of Contents

Appendices

Figures

Tables

Acronyms & Abbreviations

AAM – Advanced Air Mobility
AC – Advisory Circular
AC – Alternating Current
ACRES – Assessment, Cleanup, and Redevelopment Exchange System
ACRP – Airport Cooperative Research Program
ACT – Advanced Charging Technologies
ADO – Airport District Office
AFB – Air Force Base
AIP – Airport Improvement Program
ALP – Airport Layout Plan
AOA – Air Operations Area
API – Application Programming Interface
ARB – Ann Arbor Municipal Airport
ARFF – Aircraft Rescue and Fire Fighting
BTL – Battle Creek Executive Airport
CATEX – Categorical Exclusion
CCS – Combined Charging System
CEQ – Council on Environmental Quality
CFR – Code of Federal Regulations
CTOL – Conventional Takeoff and Landing
DC – Direct Current
EA – Environmental Assessment
EB – Engineering Brief
eCTOL – Electric Conventional Takeoff and Landing
eGSE – Electric Ground Support Equipment
eVTOL – Electric Vertical Takeoff and Landing
EGLE – Environment, Great Lakes, and Energy
EH – Extreme Heat
EIS – Environmental Impact Statement
EP – Extreme Precipitation
EPA – Environmental Protection Agency
eSTOL – Electric Short Takeoff and Landing
EV – Electric Vehicle
EVTOL – Electric Vertical Take-Off and Landing
EWR – Newark International Airport
EJ – Environmental Justice
FAA – Federal Aviation Administration
FLL – Fort Lauderdale-Hollywood International Airport
FT – Foot or Feet
FY – Fiscal Year
GA – General Aviation
GHG – Greenhouse Gas
GRR – Grand Rapids International Airport
GSE – Ground Support Equipment
HVAC – Heating, Ventilation, and Air Conditioning
IOT – Internet of Things
IPaC – Information for Planning and Consultation
JFK – John F. Kennedy International Airport
kWh – Kilowatt-hour
LAN – Lansing Capital Region International Airport
LGA – LaGuardia International Airport
LLC – Limited Liability Company
MAC – Michigan Aeronautics Commission
MASP – Michigan Aviation System Plan
MDOT – Michigan Department of Transportation
Mhe – Material handling equipment
MI – Michigan
Mph – Miles per Hour
MITP – Michigan Transportation Plan
MW – Megawatt
NAAQS – National Ambient Air Quality Standards
NEPA – National Environmental Policy Act
NEVI – National Electric Vehicle Infrastructure
Nmi – Nautical Miles
NPL – National Priorities List
NOFO – Notice of Funding Opportunity
NWI – National Wetlands Inventory
NYC – New York City

OEM – Original Equipment Manufacturer
ORD – Chicago O'Hare International Airport
PA – Pennsylvania
PAV – Passenger Air Vehicle
PCA – Pre-Conditioned Air
PVC – Polyvinyl chloride
R&D – Research and Development
RAM – Regional Air Mobility
SFO – San Francisco International Airport
STOL – Short Takeoff and Landing
TLOF – Touchdown and Liftoff
TRB – Transportation Research Board
TRI – Toxic Release Inventory
TVC – Cherry Capital- Traverse City Airport
TX – Texas
UAM – Urban Air Mobility
UAS – Uncrewed Aircraft System
UL – Underwriters Laboratories (standard/certification in electrical products)
UPS – United Postal Service
US – United States of America
USEPA – United States Environmental Protection Agency
USFWS – United States Department of Fish and Wildlife Service
VALE – Voluntary Airport Low Emissions Program
VTOL – Vertical Takeoff and Landing
WA – Washington
YIP – Willow Run Airport
ZEV – Zero Emission Vehicle

References

1. Transportation Research Board. ACRP Research Report 236, Preparing Your Airport for Electric Aircraft and Hydrogen Technologies. Accessible at: https://www.trb.org/Publications/Blurbs/182682.aspx
2. Michigan Department of Transportation. MI Transportation Plan. Accessible at: https://www.michigan.gov/-/media/Project/Websites/shared/Large-Files/documents/mdot/2040-MI-Transportation-Plan---Executive-Summary.pdf?rev=9a5d2d6e819f4446b505ad0b4be4e2b3
3. Michigan Department of Transportation. 2017 Michigan Aviation System Plan. Accessible at: https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Travel/Mobility/Aero/Planning-and-Development/MASP/Michigan-Aviation-System-Plan.pdf?rev=5734db635ef54e709b029f844d6866a4&hash=5B67F4C70C25B192B7790570F62D48BA
4. Michigan Department of Transportation. Michigan Mobility 2045. Accessible at: https://www.michigan.gov/mdot/programs/planning/slrp
5. Michigan Department of Transportation. Michigan Aeronautics Commission Annual Report – 2022. https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/About-Us/Commissions/MAC/MAC-Annual-Report-FY22.pdf?rev=a7e540e846884e4db08e5ad75e687ffa&hash=48D5A06126CA75BE002CCBAADE98A11B
6. Transportation Research Board. ACRP Research Report 236, Preparing Your Airport for Electric Aircraft and Hydrogen Technologies. Accessible at: https://www.trb.org/Publications/Blurbs/182682.aspx
7. Transportation Research Board. ACRP Research Report 243, Urban Air Mobility: An Airport Perspective. Accessible at: https://www.trb.org/Publications/Blurbs/182927.aspx
8. Federal Aviation Administration. Advisory Circular 150/5390-2D, Heliport Design, Accessible at: https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_150_5390_2D_Heliports.pdf
9. Federal Aviation Administration. Engineering Brief No. 105, Vertiport Design. Accessible at: https://www.faa.gov/airports/engineering/engineering_briefs/engineering_brief_105_vertiport_design
10. SMG Consulting. Advanced Air Mobility. Accessible at: https://aamrealityindex.com/
11. Michigan Environment, Great Lakes, and Energy. Charge Up Michigan Program. Accessible at: https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans/charge-up-michigan-program
12. Michigan Environment, Great Lakes, and Energy. National Electric Vehicle Infrastructure Formula Program. Accessible at: https://www.michigan.gov/mdot/travel/mobility/initiatives/nevi
13. Federal Aviation Administration. Voluntary Airport Low Emissions Program (VALE). Accessible at: https://www.faa.gov/airports/environmental/vale
14. Federal Aviation Administration. Airport Zero Emissions Vehicle and Infrastructure Pilot Program. Accessible at: https://www.faa.gov/airports/environmental/zero_emissions_vehicles
15. ResearchGate. Assessing the magnitude and uncertainties of the burden of selected diseases attributable to extreme heat and extreme precipitation under a climate change scenario in Michigan for the period 2041–2070; Carina J Gronlund PhD, MPH, Lorraine Cameron, Claire Shea, and Marie O'Neil. Accessible at: https://www.researchgate.net/publication/332716023_Assessing_the_magnitude_and_uncertainties_of_the_burden_of_selected_diseases_attributable_to_extreme_heat_and_extreme_precipitation_under_a_climate_change_scenario_in_Michigan_for_the_period_2041-2070
16. ResearchGate Wave Climate Associated With Changing Water Level and Ice Cover in Lake Michigan; Chenfu Huang, Longhuan Zhu, Gangfeng Ma, Guy A. Meadows, Pengfei Xue; Accessible at: https://www.researchgate.net/publication/355985648_Wave_Climate_Associated_With_Changing_Water_Level_and_Ice_Cover_in_Lake_Michigan

Executive Summary

The global transportation system has historically relied on liquid fossil fuels as its energy source. Airports are no different, with petroleum serving as the primary fuel for aircraft, ground support equipment (GSE), and passenger transportation vehicles. Due to climate change, urban areas failing to meet National Ambient Air Quality Standards (NAAQS), and the instability surrounding fossil fuel supply, there has been a significant and rapid growth in the adoption of electric technologies. In particular, the aviation industry is actively researching and developing electric aircraft for application in both Urban Air Mobility (UAM) and Regional Air Mobility (RAM) trips spanning distances of less than 250 nautical miles.

The Michigan Department of Transportation (MDOT) retained C&S Engineers, Inc. (C&S) and its subconsultant, Hovecon, LLC (Hovecon) to perform the research services for Phase 1 of a Multimodal Airport Charging Station Deployment (MDOT Project #23-019). A multimodal charging station can provide charging services at a minimum, for both aircraft and passenger vehicles. The principal objectives of this research were twofold:

- Conduct a feasibility analysis for a multimodal charging station at a Michigan Airport.
- Provide recommendations on design and implementation of multimodal charging stations.

Airports have been promoting electrification for several years, primarily focusing on gate electrification, preconditioned air (PCA) and charging infrastructure. However, as electric vehicles become increasingly common among passengers and employees, and with the emergence of electric aircraft, research organizations like the Airport Cooperative Research Program (ACRP) are actively conducting studies to aid airports in planning and implementing infrastructure for electric aircraft. Specifically, ACRP Research Report 236: Preparing Your Airport for Electric Aircraft and Hydrogen Technologies [1], stresses the importance of developing charging infrastructure in correlation with electric aircraft to ensure efficient operations. Long-term electrical planning is necessary to ensure electric systems possess the required capacity and resilience as new technologies continue to evolve.

In order to determine the most feasible airport for the initial multimodal charging station, a comprehensive process was employed. This involved assessing and ranking Tier 1 (airports that respond to essential/critical state airport system goals and objectives) and Tier 2 airports (airports that complement the essential state airport system functions and/or respond to local community needs) according to the Michigan Aviation System Plan (MASP) within the State of Michigan by utilizing publicly available data and survey responses regarding their existing infrastructure and interest in hosting a multimodal charging system. From this initial analysis involving 95 airports, six airports were short-listed for further analysis. Of this list, three were identified as General Aviation (GA) airports, two as primary non-hub airports, and one as a primary small hub airport. From this short-list, site visits and further evaluations were conducted.

Lansing Capital Region International Airport (LAN) was chosen as the initial site for deployment of the multimodal station. In ranking the most feasible airport according to the methodology, LAN is believed to possess

[1] Transportation Research Board. ACRP Research Report 236, Preparing Your Airport for Electric Aircraft and Hydrogen Technologies. Accessible at: https://www.trb.org/Publications/Blurbs/182682.aspx Accessed 5/28/2024.

adequate power capacity, located in an area classified as disadvantaged, proximate to other airports that service as destinations for electric aircraft, and is supported by Advanced Air Mobility (AAM) operators and manufacturers who have demonstrated a considerable focus for electric aircraft charging. Subsequent ranking airports identified in this analysis include Gerald R. Ford International Airport (GRR) located in Grand Rapids and Willow Run Airport (YIP) located in Ypsilanti.

The preliminary design of a multimodal charging station can charge two electric aircraft and four passenger vehicles simultaneously. Capital equipment would include concrete pads, 750KVA transformer, distribution panel, chargers, associated hoses and connectors, a monitoring system, conduits, and bollards. The opinion of probable construction cost for such a charging station is estimated to be approximately $1.081 million. This preliminary design could be reproducible and scalable at other airports, although final design based on site specific requirements would be necessary.

The Federal Aviation Administration (FAA) requires that the development of charging and electrical infrastructure projects to support electric aircraft are approved through an update to an airport's Airport Layout Plan (ALP). This process would likely require environmental review under the National Environmental Policy Act (NEPA). The current FAA NEPA guidance outlined in FAA Orders 1050.1F and 5050.4B does not specifically address electric aircraft. However, forthcoming updates are anticipated to incorporate more comprehensive details and guidance pertaining to electric aircraft and the infrastructure required to support them.

As outlined in this report, the following recommendations are directed towards MDOT and affiliated Michigan airports, particularly in anticipation of electric aircraft and the growing demand for passenger vehicle charging facilities at airports:

1. Conduct final design of a multimodal charging station at a specific airport. Following design, bid, and construction, the multimodal charging station will serve as an example to other airports about the minimal requirements necessary and potential features available for other future aircraft charging facilities.
2. Continue to work with electric charger and electric aircraft manufacturers to locate a manufacturing location at or near a Michigan airport. The ability to have chargers with the power to support aircraft can be advantageous in siting a manufacturing facility.
3. Inform and promote the construction of aircraft charging capabilities at both General Aviation (GA) and commercial airports across the state. Although LAN was selected for locating the initial multimodal charging station, the analysis indicated that other airports across the state could be locations that support electric aircraft.
4. Identify potential funding initiatives within Michigan and the FAA to offset the costs of construction of electrical infrastructure to support electric aircraft. Section 745 of the FAA Reauthorization Act of 2024 establishes a five year Electric Aircraft Infrastructure Pilot Program, which allows up to 10 eligible airports to acquire, install, and operate charging equipment for electric aircraft and to construct or modify related infrastructure to support such equipment.
5. Work with the FAA, specifically the Detroit ADO, on the approval process for electric aircraft and the requirements for siting and constructing electric infrastructure for increased power demand and chargers.
6. Continue to stay abreast with published research related to the electric aircraft and airports, including ACRP and other FAA funded research.

The following Implementation Plan provides recommendations and an associated schedule derived from this research.

Michigan Department of Transportation Multimodal Airport Charging Station Deployment Implementation Plan

Task Description
Completion of Final Phase 1 Deployment Report
Construction of initial multimodal charging station
Initiate discussions with FAA Detroit ADO
Airport undertakes final design
Apply for available funding opportunities
Complete construction of multimodal charging station
Locate a charger or electric aircraft manufacturer in Michigan
Initiate discussions with manufacturers
Initiate discussions with airports and communities
Manufacturer selects Michigan site for manufacturing facility
Promote construction of electric charging infrastructure at other airports
Target two GA airports
Target two primary airports
Research funding opportunities and published research on electric aircraft

On July 17, 2024, the Executive Office of the Governor announced four projects will receive $6.25 million in total funding to scale critical AAM infrastructure and deploy pilots that will generate operational data to validate the commercial potential of key AAM use cases and help inform the state's AAM policy. One of the four projects receiving funding is BETA Technologies installing multimodal chargers at Cherry Capital Airport, Capital Region International Airport, West Michigan Regional Airport (BIV), and Willow Run Airport to create a foundational intrastate charging network to support operations of next generation aircrafts and drive down costs for regional transportation operators.

Section 1

Introduction & Background

1.1 Introduction

The Michigan Department of Transportation (MDOT) retained C&S Engineers, Inc. (C&S) and its subconsultant, Hovecon, LLC to perform the research services for Phase 1 of a Multimodal Airport Charging Station Deployment (MDOT Project #23-019). A multimodal charging station will be able to electrify and charge electric aircraft, ground support equipment (GSE), ground access vehicles, and passenger vehicles at an airport. For this project, a multimodal charging station is considered electrical infrastructure that can charge both electric aircraft and personal vehicles. The primary objective of the research is as follows:

- Conduct a feasibility analysis for a multimodal charging station at a Michigan Airport.
- Provide recommendations on design and implementation of multimodal charging stations.

The scope of services for the project included:

- A literature review of the current initiatives in the State of Michigan and previous research regarding multimodal charging facilities.
- An evaluation of the charging technology, monitoring systems, and electric aircraft.
- Selection of a Michigan airport that has or will have the electrical capacity necessary to support electric aircraft in the near future as well as connectivity to other airports supporting electric aircraft.
- The preparation of a preliminary design of a multimodal charging station.
- The development of an implementation plan that recommends key initiatives to support electric aircraft and multimodal charging stations.

1.2 Industry Background

Sustainability is a key issue for the aviation industry with many airports undertaking initiatives to reduce the combustion of petroleum products. Such initiatives include installing photovoltaics to generate electricity for both the airport and the electrical grid and electrifying its facilities through the placement of electric chargers in areas such as:

- Passenger and employee parking lots for personal electric vehicles (EVs)
- Maintenance areas for shuttle buses and airport vehicles
- Boarding bridges for electric ground support equipment (eGSE)
- Rental car areas for rental EVs

Charging stations have traditionally been for a single vehicle or piece of equipment, such as an electric vehicle (EV). To date, there is not a commercially available multimodal charging station which can charge an electric aircraft, EVs, eGSE, and/or public transport vehicles. However, some chargers, such as BETA chargers (described in Section 3.3) can be used to charge both aircraft and ground vehicles. While EVs and equipment are common, electric aircraft are in their infancy.

Electric aircraft are viewed by the aviation industry as a one potential method for reducing the greenhouse gas (GHG) emissions currently generated by aviation operations across the world. While various electric aircraft manufacturers have developed a variety of electric aircraft models, as of the publication of this report, there are currently few electric aircraft certified for flight globally, and there are no electric vertical takeoff and landing (eVTOL) aircraft certified for flight in the United States.

This research project documents the current state of the electric aircraft and charging industry and summarizes the evaluation of Michigan airports to deploy an initial multimodal charging station while providing preliminary design parameters for an initial multimodal charging system.

Section 2

Literature Review

The initial phase of this research project involved reviewing documentation associated with the State of Michigan's plans for electric aircraft and multimodal charging as well as past research by Federal organizations. The goal of the literature review was to identify the State of Michigan's objectives associated with charging infrastructure supplemented by those of previous studies published by the aviation industry and other organizations. These documents set the framework on what is currently available and potential trends in the aviation industry.

2.1 2040 Michigan Transportation Plan Goals

The 2040 Michigan Transportation Plan (MITP) outlines the future of transportation within the state, particularly its economic activity, efficient and effective operations, safety and security, and stewardship [2]. The MITP provides a strong foundation and justification for pursuing multimodal charging infrastructure across the state and lists four goals that can be supported by pursuing multimodal airport charging:

1. System Improvements
   - Modernize and enhance the transportation system to improve mobility and accessibility.
   - Expand upon intermodal connectivity and the number of modal options for freight and passengers.
2. Efficient and Effective Operations
   - Improve the efficiency and effectiveness of the transportation system and transportation services.
   - Expand existing system capacity through the application of new technologies and strategies.
   - Coordinate transportation services supplied by both public and private sector providers.
3. Safety and Security
   - Improve transportation safety by providing a safe environment for transportation users through engineering, enforcement, and education activities.
4. Stewardship
   - Protect the environment and utilize public resources in a responsible manner.
   - Maximize the benefits of transportation investment to the Michigan economy.

[2] MDOT. MI Transportation Plan. Accessible at: https://www.michigan.gov/-/media/Project/Websites/shared/Large-Files/documents/mdot/2040-MI-Transportation-Plan---Executive-Summary.pdf?rev=9a5d2d6e819f4446b505ad0b4be4e2b3 Accessed 5/28/2024.

2.2 2017 Michigan Aviation System Plan

The Michigan Aviation System Plan (MASP) details the value of airports within the state's network [3]. The MASP highlights public-use airports and is a critical resource to stakeholders interested in maintaining and enhancing air travel. The 2017 MASP was developed at a time when EV and aircraft technologies were much less mature than they are today. Consequently, the MASP does not address the need for, or implications of, expanded multimodal airport charging stations across Michigan. While the MASP briefly discusses Uncrewed Aircraft Systems (UAS), the report does not provide detailed information for airports across the state to plan for or deploy electric chargers or expanded multimodal airport charging stations across the state. The MASP lists all MI airports, their tier ranking, location and distance from urban areas (including projected and existing "population centers" and "business centers"), as well as information on fossil fuel use and fueling strategies.

Figure 2.1 - 2017 MASP

2.3 Michigan Mobility 2045

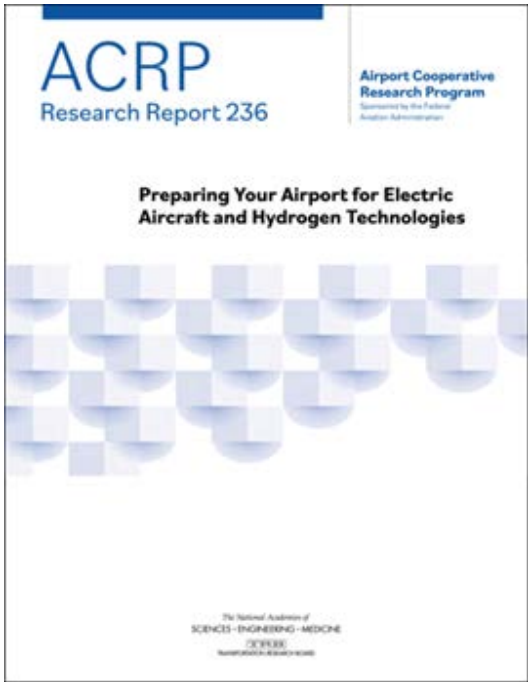
Michigan Mobility 2045 (MM2045), also known as the State Long-Range Transportation Plan is a 25-year plan for transforming Michigan's transportation system [4]. MM2045 includes guidance and direction for deployment of charging stations, emphasizes the importance of multimodal transportation options across Michigan, and offers strategies for enabling adoption for increased use of EVs. However, airport charging stations, particularly those geared towards charging electric aircraft, are not specifically addressed in this plan.

[3] MDOT. 2017 Michigan Aviation System Plan. Accessible at: https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Travel/Mobility/Aero/Planning-and-Development/MASP/Michigan-Aviation-System-Plan.pdf?rev=5734db635ef54e709b029f844d6866a4&hash=5B67F4C70C25B192B7790570F62D48BA Accessed 5/28/2024.

[4] MDOT. Michigan Mobility 2045. Accessible at: https://www.michigan.gov/mdot/programs/planning/slrp Accessed 5/28/2024.

2.4 MDOT Aeronautics Commission Annual FY 2022 Report

The Michigan Aeronautics Commission (MAC) and MDOT's Office of Aeronautics Annual Fiscal Year (FY) 2022 Report briefly addresses potential electric power implementation at airports in the context of UAM use [5]. The Office of Future Mobility and Electrification is mentioned, but the report does not go into detail in its role. The report summarizes the changes that airports have undergone in the last year as well as potential changes to airport systems, management, and infrastructure.



2.5 Electric Vehicle Charger Placement Optimization in Michigan 2020

The purpose of the Electric Vehicle Charger Placement Optimization report is to provide an overview of the implementation process for EC charging stations in Michigan. It highlights features to be mindful of when implementing this new infrastructure such as the power needed to charge different types of vehicles, how weather will affect charging stations, and why a charging stations location is more important than battery size. This report also outlines the cost of charging station implementation and average daily queue time providing an optimization model for the price and use of the chargers. The report does not address charging infrastructure at airports.

2.6 ACRP Research Report 236: Preparing Your Airport for Electric Aircraft and Hydrogen Technologies

The Airport Cooperative Research Program (ACRP) Research Report 236, published in 2022, estimates that by 2025 most airports will have a small fleet of electric aircraft and that to meet growing electricity demand, airports may wish to invest in multimodal charging stations [6]. With a large range of vehicles and an even greater variance between airplane models, a multimodal or multi-standard charging station provides flexibility to an airport. In this report, a multimodal charging station is defined as a charging hub that can support different charging plugs for various vehicles. With manufacturers creating aircraft with different charging ports, multimodal charging hubs may be a solution for airports.

Initial plans for airports to become fully electric involve planning for small capacity aircraft with a maximum of 20 passengers that are traditionally used for short haul flights such as air taxi services or flight training. Airports will need to prioritize improving their electrical infrastructure to meet charging demands. Some airports will require upgrades to their overall power supply to increase electrical capacity, through energy efficiency upgrades, receiving additional power from the grid, or developing on-site electricity generation, such as microgrids.

[5] MDOT. Michigan Aeronautics Commission Annual Report – 2022. Accessible at: https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/About-Us/Commissions/MAC/MAC-Annual-Report-FY22.pdf?rev=a7e540e846884e4db08e5ad75e687ffa&hash=48D5A06126CA75BE002CCBAADE98A11B Accessed 5/28/2024.

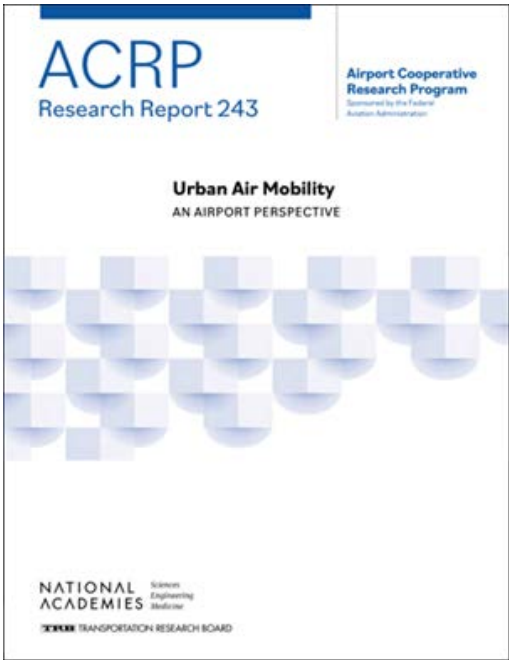
[6] TRB. ACRP Research Report 236, Preparing Your Airport for Electric Aircraft and Hydrogen Technologies. Accessible at: https://www.trb.org/Publications/Blurbs/182682.aspx Accessed 5/28/2024.

To prevent a complete shutdown in the event of a natural disaster, resiliency must be planned such as identifying emergency energy sources. Emergency options include large cell battery backups for storing excess electricity, or use of hydrogen power, whether for aircraft or generators. Since electric aircraft are still in the developmental stages, one of the issues with electric integration is the current limited range of travel before charging is needed. Whether or not multimodal charging stations will be resilient and reliable is unknown due to uncertainties surrounding power supply and production. Presently, there are three potential charging solutions associated with electric aircraft, including:

- Charging stations currently utilized by EVs
- Recharging through truck mounted superchargers and batteries
- Swapping batteries for charging at gates

ACRP Research Report 236 highlights the importance of developing charging infrastructure in correlation with electric aircraft and vehicles to ensure efficient operations. It also covers the importance of long-term electrical planning to ensure electric systems are resilient as new technologies continue to emerge. To assist with long-term planning for electric charging needs for electric aircraft, ACRP Research Report 236 includes an airport electric demand assessment tool. Future needs for chargers should be projected and included on Airport Layout Plan (ALP) drawings depicting future electric aircraft parking areas. Section 10 of this report summarizes the methodology for regulatory approval for the installation of chargers at airports.

2.7 ACRP Research Report 243: Urban Air Mobility: An Airport Perspective



ACRP Research Report 243 provides an assessment of potential impacts of UAM at airports and assists airports in understanding potential opportunities and planning considerations [7]. Advanced Air Mobility (AAM) includes the use of new aircraft types to transport passengers and cargo at lower altitudes and includes electric vertical takeoff and landing (eVTOL). AAM is an emerging technology and due to delays in Federal certification, no eVTOL are currently certified for operation worldwide today. The first FAA eVTOL certification is anticipated to occur between 2025 and 2028.

AAM adoption requires robust coordination and planning among airports, agencies, and communities. It is recognized that community inclusion will be critical for the successful implementation and integration of AAM. Early UAM operations are crewed flights that utilize existing helicopter routes and visual flight rules (VFR) while working toward operations that will allow for instrument flight rules (IFR).

The AAM market in the long-term is expected to include a variety of use cases including commercial, regional, and UAM travel, Regional Air Mobility (RAM), cargo delivery, public services, and private/recreational use. While in its infancy, the initial AAM ecosystem is expected to utilize both new and existing facilities (airports or heliports and existing applicable routes). In the future, new dedicated facilities and routes will likely be developed. A key to the success of AAM is the engagement of communities in the integration of UAM at airports. Progress

[7] TRB. ACRP Research Report 243, Urban Air Mobility: An Airport Perspective. Accessible at: https://www.trb.org/Publications/Blurbs/182927.aspx Accessed 5/28/2024.

towards meeting environmental and sustainability requirements, educating the public on AAM operations, and successful marketing toward public desirability are key factors for successful UAM adoption. ACRP estimates an AAM turnaround time of 15-20 minutes from landing, disembarking, refueling, boarding, taxi, and takeoff.

There are several operational concerns in successful eVTOL operation including wind impacts, temperature, new flight procedures, diversification of the fleet mix, and battery fires (thermal runaway).
Lessons learned associated with UAM outlined in this report include:

- The need to address pedestrian and worker safety.
- Consideration for the operator agnostic aircraft rather than brands or models from particular original equipment manufacturers (OEMs).
- The need to plan AAM implementation requirements early-on to identify stumbling blocks.
- Consideration for the implementation of a pilot project for low-risk AAM exploration.
- The need to centrally locate vertiports (as opposed to isolated vertiports) with consideration for the passenger experience.

2.8 FAA Advisory Circular 150/5390-2D

An advisory circular (AC) is a publication offered by the Federal Aviation Administration (FAA) that provides guidance for compliance with airworthiness regulations, pilot certification, operational and infrastructure standards, training standards and any other rules within the 14 Code of Federal Regulations (CFR) Aeronautics and Space title.

AC 150/5390-2D, Heliport Design, provides standards for the design of heliports primarily serving helicopters with single rotors [8]. Basic concepts can also be applied to heliports serving tandem (front and rear) or dual (side by side) rotors although many of the standards will not be applicable. The standards include structure considerations for touchdown and liftoff areas (TLOF), clearance between parking areas and taxi routes within parking areas, minimum dimensions of curved approach/departure airspace, and guidance markings/lighting. This AC has been used in the design of initial eVTOLs landing/takeoff areas.

2.9 Engineering Brief No. 105, Vertiport Design

The FAA has released an Engineering Brief (EB) 105 on vertiport and vertistop design to support AAM aircraft [9]. A vertiport is a section of land, water, or structure intended for either manned or unmanned vertical takeoff and landing of aircraft, along with the associated buildings and facilities. A vertistop has the same geometry and airspace as a vertiport but no fueling, defueling, scheduled maintenance, scheduled repairs, or storage of aircraft is permitted. A vertistop facility is meant for the discharge of passengers or cargo only. These structures fall under the category of AAM infrastructure.

This EB provides design guidance for vertical takeoff and landing (VTOL) aircraft powered with electric motors and utilizing disturbed electric propulsion in contrast to propulsion systems. Design guidance is provided for public and private vertiports and vertistops, including modification of existing helicopter and airplane landing facilities, and establishment of new sites.

[8] FAA. Advisory Circular 150/5390-2D, Heliport Design, Accessible at: https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_150_5390_2D_Heliports.pdf Accessed 5/28/2024.

[9] FAA. Engineering Brief No. 105, Vertiport Design. Accessible at: https://www.faa.gov/airports/engineering/engineering_briefs/engineering_brief_105_vertiport_design Accessed 5/28/2024.

2.10 Conclusion

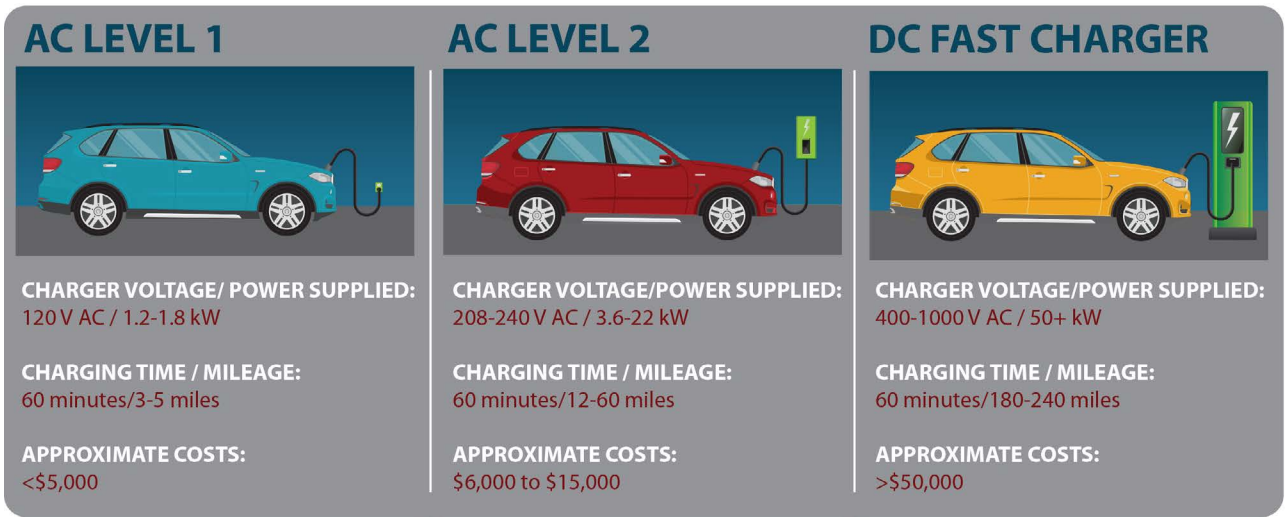
The literature review revealed that local communities, research organizations, MDOT, and the FAA are continuing research to assist airports in planning and implementing infrastructure for electric aircraft. ACRP studies, particularly ACRP 236, underscores the importance of developing charging infrastructure in correlation with electric aircraft and EVs to ensure efficient operations. Long-term electrical planning is necessary to ensure electric systems are resilient as new technologies continue to develop. References to electric aircraft in the documents published by the State of Michigan are limited, but MDOT has funded the EV report, Electric Vehicle Charger Placement Optimization in Michigan, which highlights recommendations when implementing charging infrastructure and proposed locations throughout the state.

Section 3

Charging Systems and Batteries

Electric charging manufacturers for EVs and eGSE offers a variety of charging options. Level 1 chargers are typically used in residential settings and not viable for aircraft. Level 2 chargers require higher voltage and charge vehicles in 3-4 hours, while fast chargers utilize direct current (DC) power for the quickest charge and highest equipment costs.

Figure 3.1 – Types of Electric Vehicle Charges



Since electric aircraft development is in its infancy, the chargers available for electric aircraft vary tremendously, with some offering a combination of charging and cooling, and others offering a similar approach as vehicle fast charging. Since a multimodal charger deployment needs to service EVs, electric aircraft, and potentially eGSE, the use of chargers with multi-functional use may be limited. The following provides a summary of various charger manufacturers.

3.1 PosiCharge

PosiCharge is one of the two primary suppliers of eGSE chargers for airports in the United States. The PosiCharge line of outdoor fast chargers offers the benefits of a large charging system without the added maintenance and infrastructure costs. They have a patented system with the ability to charge up to 16 vehicles simultaneously, and to share power with existing infrastructure, such as jet bridges. Their intelligent battery management technology directs power to the batteries that need it most, while keeping the temperature in an ideal range to extend battery life. PosiCharge promotes advanced safety technology, fleet management, and rugged design in their charger and monitoring systems.

The main benefit of PosiCharge is the ability to share power and charge multiple vehicles or GSE through a single charger. The charger, along with its monitoring system (discussed in Section 4.1)

provides a single charger monitoring system. It should be noted that PosiCharge has focused their charging on electric material handling equipment and GSE and has not ventured into electric aircraft charging to date.

3.2 Minit

Minit is a major supplier of eGSE charging equipment to airports. With over two decades of expertise, Minit fast chargers are designed for industrial applications like airports, warehouses, and ports. Minit offers universally compatible applications that integrate with AssetPro 360, a cloud-based analytics platform, offering remote equipment monitoring for prolonged equipment life. Minit has updated its charger with the Altus II, which is its new dual-port charger, built with state-of-the art silicon carbide (SiC) technology. The Altus II simultaneously provides multiple eGSE with a faster charge in a smaller footprint. The Maximus boasts two charging ports to power two material handling equipment (mhe) simultaneously. It offers the ability to recharge two fully depleted batteries in three hours delivering exceptional performance. Both the Altus II and Maximus chargers wirelessly share crucial charging data to AssetPro 360.

The Minit charger has been used for eGSE and other industrial settings, but their research into chargers to handle aircraft is unknown.

3.3 BETA Technologies

BETA Technologies has designed chargers and monitoring software for some of their initial electric aircraft sites. The initial BETA charger model is quite similar to a standard Level-3 electric car charger offering interoperable, multimodal charging for electric vehicles and airside electric aircraft. The second iteration of the BETA charger is the BETA Charge Cube (See Figure 3.2). This charging solution is compact and provides built-in cable management with a 50-foot charging radius provided through a retractable reel and standardized Combined Charging System (CCS)-1 charging connector. The charge cube provides a 320kW DC fast charger connected to the power grid by a 320kW AC/DC inverter. A third BETA charger, the Mini Cube is currently in development and provides a self-contained charging option for Level-3 charging of aircraft as well as electric vehicles and electric buses. The Mini Cube is set on caster wheels to allow for mobile charging and increased safety as the charger and cables can be moved at the completion of charging while minimizing trip and fall hazards in small spaces. Both the BETA Charge Cube and Mini Cube can charge an electric aircraft in approximately 15-20 minutes. BETA charging options include extra space and electrical loads for HVAC, battery cooling, etc., which drives up the size of the electrical requirements for this system. While this need for space is likely not an issue for smaller airports, this could become a space issue when installing four or more chargers in a limited space. Both the BETA Charging Cube and Mini Cube have been UL certified demonstrating their proven safety in operations.

Figure 3-2 – BETA Charge Cube

Beta Technologies and Archer Aviation, two leaders in the eVTOL industry, are collaborating on the adoption of a shared charging system for electric aircraft, one that hopefully any eVTOL model can use.

3.4 Volatus

Volatus Infrastructure is an AAM company developing multimodal charging stations with the intent to accommodate eVTOL, electric vehicles, electric commercial trucks, electric boats, electrified heavy machinery, and electrical aircraft (eCTOL, electric conventional takeoff and landing). According to Volatus representatives, initial vertiports will be sited on the grounds of airports as well as close to the downtown of a community as possible. A Volatus charging station will accommodate the charging of up to seven eVTOLs at one time with approximately 1 MW of power required per eVTOL and a total of seven megawatts per multimodal charging station required. Volatus is planning for all vertiport infrastructure to exist within 1-square acre likely in a "hub and spoke" set-up. Volatus's approach is locating charging stations for accessibility.

Volatus envisions a network where any manufacturer can utilize their multimodal charging system. There is a wide consensus from their perspective on connectors and the CCS protocol, which is set up to be the standard in North America. In addition, Volatus is working on proprietary software to optimize energy draw at Volatus charging stations with an ability to establish priorities at stations based upon vehicle type and need. In those cases where such a priority is warranted, this software will have the ability to manage electricity distribution locally.

For Volatus, as with all charging systems, a major challenge is grid capacity to handle electric aircraft. According to Volatus representatives, existing electrical grid capacity is expected to accommodate the expected electrical loads for eVTOL only through 2025. Beyond this point, additional coordination with utility companies and considerations for additional electrical capacity will be necessary to accommodate technological advancements in electrification.

3.5 Ferrovial

Ferrovial is a global infrastructure operator that designs, builds, and operates infrastructure for eVTOL. Ferrovial is planning for vertiports of a relatively small size of 1.5 to 2 acres with site locations chosen based on energy capacity and then "wrapped around energy" sources. Ferrovial is familiar with the multimodal charging station approach and is amiable to installation of a single charging unit with applications for both eVTOL and EVs with the same CCS connector type. Ferrovial anticipates that vertiport charging will be like standard EV charging and is looking at chargers up to 400kW with the intention of charging an eVTOL within a range of 15 to 20 minutes. Ferrovial plans for a 4-stand vertiport model requiring 400kW per stand and a total of approximately 2 MW from the electric grid.

Source: Ferrovial

To provide a supplement to grid-source energy, Ferrovial is looking at microgrids or battery energy storage including the potential benefits of on-site energy generation intended to reduce the vertiport's impact to the grid. A challenge indicated by Ferrovial is thermal management of the battery and charger. Ferrovial is not currently planning on operations in cold-weather climates like Michigan and expects demand to direct success in warm-weather climates such as West Palm Beach, Florida.

3.6 VIRV

VIRV is an airside swappable battery storage start-up company. VIRV has been in pursuit of an aviation concept since 2023 to fill what they see as a gap in the marketplace, swappable battery-powered electric GSE for the airport environment. The VIRV model is unique as it provides a gap in the DC/AC system with a DC/DC system alternative. VIRV batteries recharge via a trailer concept designed for airports known as a battery taxi that can charge 20-50 GSE's worth of batteries on one trailer. The VIRV business model aims to fill gaps in the airport airfield ecosystem with limited downtime and the ability to provide high power. VIRV recognizes that GSE are 30-to-50-year assets that often require maintenance every five to ten years. As GSE vehicles are developed, the VIRV business model allows for replacement of traditional diesel GSE with the electric model.

Figure 3.3 – VIRV Battery Storage Unit

Source: VIRV

Since the VIRV battery is swappable, it is designed for eGSE, buses, and other vehicles/equipment operating at an airport. Therefore, it is not a recommended option for a multimodal charging station which would require the charging of electric aircraft.

3.7 ChargePoint

ChargePoint is one of the world's largest electric charging providers with vertically integrated hardware, software, equipment, and infrastructure installation. The flagship ChargePoint product is Express Plus, a modular charging system with the ability to be to be customized to accommodate for both charging speed and electrical capacity needs. The Express Plus system combines 40 kW blocks for a total limit of 500kW. The Express 250 (CPE 250) allows for up to 250 miles of aircraft flight time on a charge. Level 2 ChargePoint charging provides 19.2 kW. ChargePoint is focused on CCS connectors, with plug-in type connectors soon to be available.

ChargePoint Vehicle Charger
Source: ChargePoint

ChargePoint can limit the chargers to avoid exceeding the maximum demand charge. When installed, ChargePoint software is typically set-up to align with peak charging times and then automated for future ease of use. ChargePoint has existing installations in the State of Michigan for the charging of electric vehicles.

They also can provide a solar canopy for additional power or electricity to be sold back to the grid. Based on ChargePoint experience, past thermal events have not been caused by the ChargePoint EV charger, but rather an issue on the vehicle side.

ChargePoint is currently focused only on passenger vehicle charging and monitoring, rather than aircraft. ChargePoint aims to support the development of a U.S. charging network.

3.8 Skyports

Skyports is a vertiport designer, builder, owner, and operator, providing vertiport infrastructure for AAM. The Skyports team completes high-level design for broad application, then works with individual AAM provider companies to further tailor its designs. Skyports is prioritizing an electric charging station concept with standardized, OEM agnostic CCS-1 charging connectors and is partnering with Rolls-Royce, Siemens, and Atkins to design chargers for a vertiport environment. Skyports is working to understand the required electrical capacity needed, eVTOL battery functionality in cold weather, and requisite de-icing procedures to operate safely and effectively. Skyports views thermal cooling as a significant challenge as thermal management will be required to accommodate ultra-fast charging speeds.

Source: SkyPorts

3.9 Conclusion

Based on the research, there are many similarities and differences between the charger manufacturers. PosiCharge and Minit chargers focus on eGSE, while ChargePoint focuses on EVs. The selection of chargers for a multimodal application will rely on its capabilities to charge aircraft. BETA, Volatus and Ferrovial offer chargers for aircraft with a cross-compatibility for a variety of equipment charging.

Section 4

Charging Metering and Monitoring Systems

Similar to charging technology, metering and monitoring systems exhibit variability, with airports potentially employing diverse systems tailored to their specific vehicles and equipment. As such, the need to accurately monitor the usage and overall status of its charging equipment is important. Monitoring of electrical demand, usage, and charger status will assist in the following:

- Allow for submetering to recoup electricity costs
- Apply for funding or fuel credits
- Ensure the installed chargers are appropriately utilized.
- Continuously monitor for any signs of malfunction and perform preventative maintenance.
- Enable more granularity for GHG emission inventories.

The information provided below describes the various metering and monitoring platforms and technologies that exist, as well as additional areas of consideration including clean fuel credits, airline assistance with tracking, and cybersecurity concerns.

4.1 PosiCharge

PosiCharge's SkyLink, a cloud-based business intelligence platform, collects energy consumption, usage, safety, and battery performance data. Although PosiCharge has been focused on monitoring eGSE charging stations, its software features serves as an example of monitoring charger utilization and equipment-and airline-specific energy consumption . The E-meter is an IOT (internet of things) device that gets installed on each charger. The E-meter can be hardwired via Ethernet from charger to charger, or the device can use local Wi-Fi networks based on an airport's information technology (IT) security protocols.

Many airports have cybersecurity concerns related to charger monitoring. San Francisco International Airport (SFO) has been reportedly working with PosiCharge to launch of its SkyLink system, after having gone through extensive security testing. SFO's primary concern was ensuring that the monitoring system did not open any pathways for external security threats to the airport's network. PosiCharge claims that the SFO project will lay the groundwork for other airports from a security standpoint, and the company intends to make the lessons learned from this partnership available to other airports.

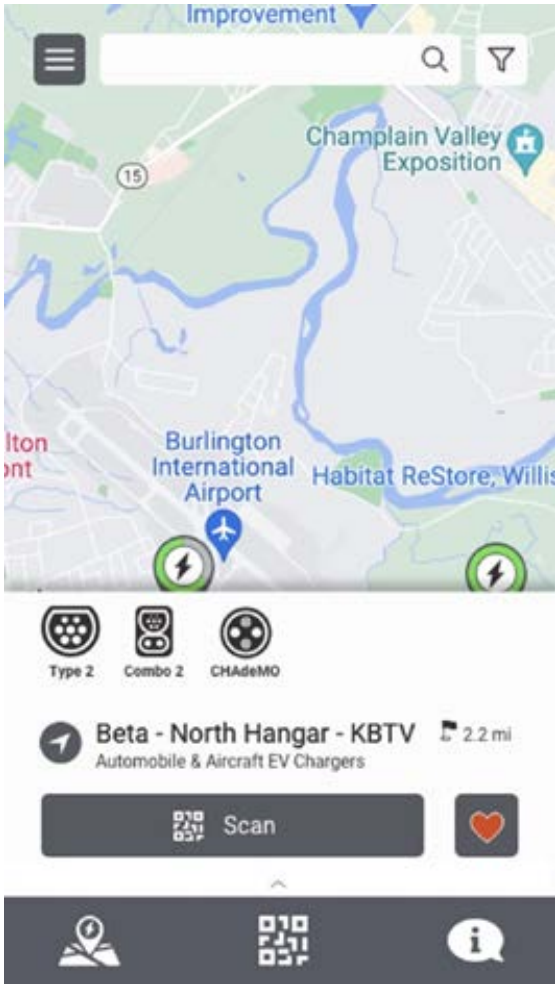
4.2 Advanced Charging Technologies (ACT)

ACT's platform features ACTintelligent, a service that monitors charger data and usage in real time. In addition to monitoring, ACTintelligent provides active, advanced energy management capabilities providing "read only" interfaces. ACTintelligent enables owners to turn chargers off at certain times of the day to support demand management initiatives or electric peak load shedding. This capability could be particularly useful to reduce costs associated with the demand portion of the electrical cost charge. Control of the chargers is accomplished through a cellular network, which ACT believes is more secure than connecting directly to the owner's local network. Cell-based routers are installed in the charging area, which transmit the information.

4.3 BETA Technologies

BETA has developed an in-house application for its electric charger network. The BETA charging app (see Figure 4.1) is accessible via smart phone connection to all users and provides the ability for plug-and-charge use for both EVs and electric aircraft. There are currently nine publicly accessible EV chargers for use on the app with a network of 55 additional chargers in permitting or construction and plans for nearly 150 additional chargers to be online in the next couple of years.

Figure 4.1 – BETA App



BETA's Charge Cube and Mini Cube owners can set pricing for charging automatically, collect payments, and control Application Programming Interface (API) to interface Charge Cube and Mini Cube with other enterprise systems. Once an aircraft is registered in the system, it is automatically detected when plugged in. Typically, there is Subscriber Identity Module (SIM) card connection for payment so hardline connection to the internet is not needed.

4.4 ChargePoint

ChargePoint provides both control and insights via its unified EV charging management software. ChargePoint provides real-time data visibility on driver details, power use, energy costs, driver revenue, and station status. Owners may set prices based on driver type, length of session, and time of use (peak vs. non-peak hours). The software prebuilds charts and visualization reporting on various features including station usage, maintenance needs to improve uptime, and environmental impacts. ChargePoint stations can be integrated with building management and energy systems to streamline operations.

4.5 Conclusion

Each of the four manufacturers researched has a unique approach to its meter and monitoring capabilities, with some offering web-based connectivity and others providing connectivity via cellular connections. Overall, metering and monitoring technology may be the most likely areas to see significant changes or improvements in the coming years as information technology continues to evolve. A concern that needs to be addressed is the cybersecurity security related to charger monitoring.

Section 5

Electric Aircraft Manufacturers

To reduce the greenhouse gas (GHG) emission impacts of aviation, several electric aircraft manufacturers and traditional aircraft manufacturers are developing electric aircraft for both conventional take-off and landing (CTOL) and vertical take-off and landing (VTOL). According to SMG Consulting, "The Vertical Flight Society counts over 900 entrants in the AAM industry with new ones added on a weekly basis.[10]"

This report addresses some of the most prominent, electric aircraft manufacturers, such as Joby Aviation, BETA Technologies, and Archer Aviation, as well as traditional aircraft manufacturers. This section outlines the current state of various models of electric aircraft by manufacturers and provides insight into their charging needs.

5.1 Joby Aviation

Joby Aviation is an eVTOL company that manufactures aircraft for the UAM market (see Figure 5.1). Joby employs a proprietary aircraft charger that utilizes ultra-fast aircraft charging and a proprietary thermo-cooling system to allow for aircraft recharge and turn-around in approximately ten minutes. The Joby charging system will be located at the subterranean level and move upwards and downwards on a hydraulic system allowing the area to stay clear. The cooling system is a significant difference between Joby and the other electric aircraft manufacturers, as a universal charging system would not be available to both Joby and other aircraft without thermo-cooling system needs.

Figure 5.1 – Joby Aviation Aircraft

Source: Aviation Today

While still awaiting certification, Joby aspires to deploy an air taxi service as soon as 2025. Joby aircraft are marketed as one of the quietest aircraft on the market with a maximum speed of 200 miles per hour (mph) and zero emissions from operation. It is anticipated that Joby aircraft will initially be implemented under a UAM model transporting passengers in dense areas from one point to another, such as from downtown New York City to John F. Kennedy International Airport or throughout the City of Los Angeles and adjacent areas. To date, Joby has flown more than 30,000 miles through test flights of eVTOL prototype aircraft. In 2023, Joby's aircraft became the first to be stationed and operated at a US Air Force Base (AFB).

[10] SMG Consulting. Advanced Air Mobility. Accessible at: https://aamrealityindex.com/ Accessed 5/29/2024.

5.2 BETA Technologies

BETA Technologies manufactures the ALIA aircraft (see Figure 5.2) which has both a fixed-wing CTOL and VTOL models and will carry a pilot and up to five passengers at one time. BETA aircraft can be charged using BETA's patented Charge Cube or a mobile charging option, the BETA Mini Charge Cube. BETA chargers utilize a standardized CCS-1 connector for charging. In 2023, the ALIA aircraft flew a possible BETA route from downtown New York City (NYC) to John F. Kennedy International Airport (JFK) and LaGuardia International Airport (LGA), marking the first time an electric aircraft has flown these key NYC corridors.

Figure 5.2 – BETA ALIA

Source: BETA Technologies

BETA Technologies is also working with United Postal Service (UPS) to supply electric aircraft for cargo operations. The movement of cargo is projected to be the initial use of electric aircraft. Therefore, airports with cargo operations will likely be the first to need electric charging stations for aircraft.

5.3 Archer Aviation

Archer Aviation's Midnight Aircraft (see Figure 5.3) is a UAM aircraft design for rapid service on short, back-to-back urban routes with minimal charge time. The Archer Midnight will fly at a maximum speed of 150 mph, carry a pilot, four additional passengers and luggage, and aims to compete with traditional ground transportation options such as ride-share or public transit. Archer's first routes will include downtown NYC to Newark Liberty International Airport (EWR), downtown NYC to JFK, the Houston Arts District to George Bush Intercontinental/Houston Airport (IAH), South Beach to Fort Lauderdale-Hollywood International Airport (FLL), and downtown Chicago to Chicago O'Hare International Airport (ORD) with all routes planned for under 20 minutes in total flight time.

Figure 5.3 – Archer Aviation Midnight Aircraft

Source: AviationWeek

5.4 Traditional Aircraft Manufacturers

When most consumers think of aircraft companies, Boeing and Airbus are the first that come to mind. Both Boeing and Airbus are working toward electric aircraft models to stay competitive in the market. Boeing's Passenger Air Vehicle (PAV) is an eVTOL aircraft planned to be fully autonomous with take-off, level flight, and landing to be completed without a pilot. The first test flights for the PAV were initiated in 2019 and as of the

publication of this report, little additional information is available on the PAV. Boeing also owns an air taxi unit, Wisk Aero, with efforts focused on the development of autonomous eVTOL aircraft.

Airbus has developed several electric aircraft models since 2010, beginning with its development of the Airbus CriCri, the first fully electric four engine aerobatic aircraft developed worldwide. Subsequent Airbus electric and hybrid-electric aircraft have included:

- The e-Genius, a 2-seater electric aircraft in 2011
- The E-fan 1.0, the first Airbus electric aircraft demonstrator (see Figure 5.5)
- The E-fan 1.1 which flew across the English Channel in 2015
- The E-Fan X hybrid electric demonstrator in 2017
- The Vahana autonomous single passenger eVTOL aircraft
- The CityAirbus, remote piloted demonstrator in 2019

Figure 5.4 – Airbus E-Fan

Source: CNN

While Airbus continues to experiment and innovate, long-term, the company aims to build electric and hybrid aircraft for regional flights transporting up to 90 people for a maximum time period of three hours. Airbus personnel expect that this goal is approximately 15 years away from being realized.

5.5 Conclusion

Electric aircraft are essentially a new frontier and will require various approvals and certifications to ensure safety equivalent to today's conventional aircraft. The FAA is requiring electric aircraft manufacturers to obtain four FAA certifications including type, airworthiness, production, and operational certifications before an electric aircraft will be cleared for commercial flight. To-date, no electric aircraft manufacturer has completed the full FAA certification process for an electric aircraft. MDOT, as well as the entire aviation industry, must stay abreast of developments in the electric aircraft and hybrid electric aircraft industry. It is expected that Hybrid and STOL models may be the first to clear the FAA approvals process and enter commercial service. In addition, the movement of cargo, rather than passengers, will likely to be the first major use of electric aircraft.

It should be noted that some of these planned electric aircraft require cooling systems as part of their charging infrastructure. For this research project, it is anticipated that the multimodal charging system will consist of a charger, charging reel, and hose utilizing a standardized CCS-1 connector, like that needed for BETA Technologies, rather than the needed thermo-cooling system for charging required by Joby aircraft.

Section 6

Selection Process

In determining the potential location for implementation of a multimodal charging station at an airport in Michigan, the project team implemented a rigorous selection process. This process entailed the following key steps:

- An initial survey of Michigan airports
- Selection of short-list of airports
- Site visits to short-listed airports
- AAM operator and manufacturer survey
- Selection of an airport for initial multimodal charging system

6.1 Initial Survey of Michigan Airports

A comprehensive process was utilized to assess and rank airports within the State of Michigan with publicly available data as well as airport responses to a survey about their current infrastructure and desire to host a multimodal charging system. This process involved the evaluation of various relevant variables to determine which airports were best positioned to excel in the emerging markets of AAM and RAM for integrating electric aircraft, encompassing both cargo and passenger movement. As part of this initial assessment, a survey form was developed and emailed to 118 airports . The initial survey was organized to capture key airport data including:

- Airport contact information
- Key airport characteristics
- Existing electrical infrastructure and ability to upgrade
- Current or future interest in AAM and past coordination with AAM operators and manufacturers
- Interest expressed in multimodal electrification

A copy of the initial survey form is provided in Appendix A. A total of 24 survey responses were received and are provided in Appendix B.

6.2 Selection of the Short-Listed Airports

During this initial phase, the Project team undertook the task of selecting key variables critical to gauge each airport's readiness for multimodal electrification. A total of 10 variables were chosen to encompass a wide range of factors, including available infrastructure at airports, area demographic data, survey results, as well as the Michigan Prosperity Regions within the state to ensure a representative assessment.

After identifying the variables and aggregating the data, the project team applied the selected variables to each of Michigan's Tier 1 and Tier 2 airports, as expressed in Figure 6.1.

Figure 6.1 – Short-List Selection Process

Based on the evaluation process, the six airports listed in Table 6.1 were recommended as the short-list of airports for further evaluation, including interviews with airport management and a site visit. A copy of the Airport Short-List Selection Narrative is provided in Appendix C.

Table 6.1 – Recommended Airports for Further Evaluation

Airport	Airport Code	MI Prosperity Region	Airport Type
Cherry Capital Airport	TVC	2	Primary – Non-Hub
Gerald R. Ford International Airport	GRR	4	Primary – Small-Hub
Capital Region International Airport	LAN	7	Primary – Non-Hub
Battle Creek Executive Airport at Kellogg Field	BTL	8	General Aviation
Ann Arbor Municipal Airport	ARB	9	General Aviation
Willow Run Airport	YIP	10	General Aviation

As shown in Table 6.1, the short-list contained three primary airports (one small hub and two non-hub) and three general aviation (GA) airports, which represent six of the ten Michigan Prosperity Regions. These airports showed the most promise in supporting a multimodal charging station and the emerging markets of AAM and RAM.

6.3 Site Visits at Short-Listed Airports

Site visits were conducted at the six short-listed airports from November 14th through November 28th, 2023. The six airports and dates visited are as follows:

- Battle Creek Executive Airport (BTL) on November 14, 2023
- Ann Arbor Municipal Airport (ARB) on November 17, 2023
- Willow Run Airport (YIP) on November 17, 2023
- Gerald R. Ford International Airport (GRR) on November 20, 2023
- Capital Region International Airport (LAN) on November 27, 2023
- Cherry Capital – Traverse City Airport (TVC) on November 28, 2023

Prior to the visits, airport staff were provided a site visit checklist (see Appendix D) with questions regarding their electrical capacity, operations, staff and space limitations, safety practices, and other items. Some airports filled out the survey in advance, and others did not. The site visits started with a general meeting with the primary airport contact and other stakeholders to talk through the survey. In each case, a short descrip-

tion/background of the project was provided, along with the goals of the site visit. In discussing the survey, if answers were unknown at the time of the site visit, follow-up conversations were held afterwards.

An aerial photo of each airport was used to discuss potential locations for a charging station on the airfield prior to a tour of the airfield and potential site locations. The aerial photo was marked up with notes, including benefits and potential issues at each location, and photos were taken of each site that was considered at each airport. The number of areas varied at each airport, depending on various factors such as the airport's size, proximity to a fence between airside/landside, and accessibility to power and other utilities.

6.4 AAM Operator and Manufacturer Survey

In order to better understand their preferences for AAM operations in Michigan and its surrounding states, AAM operators and manufacturers were contacted and surveyed. A list of operators and manufacturers contacted is provided below (listed alphabetically):

- Archer Aviation, Inc.
- Beta Technologies
- Bristow
- Eve Air Mobility
- Ferrovial
- Joby Aviation
- Skyports
- Supernal
- Volatus Infrastructure
- UPS Flight Forward

Source: Getty Images

Appendix E provides the responses received from this survey.

6.5 Airport Evaluation Criteria

The project team developed a Multimodal Charging Station Decision Matrix encompassing 16 criteria for decision-making to evaluate the short-listed airports in which the multimodal charging station could be sited. These criteria were ranked with a high weight given to the most significant for selection of the airport, a moderate weight given for those criteria that are significant, but less likely to affect the selection, and a low weight for those criteria that are important, but not as significant. Rankings were assigned as follows:

- High-priority criteria were scored between 0-2.
- Moderate criteria were scored between 0-1.
- Low-priority criteria scored between 0-0.5.

"Electrical Capacity", along with "Connectivity to Other Airports with Electric Aircraft" and "Social Equity" were considered the three most high-priority criteria and given a score that could vary between 0-2. "Electrical Redundancy" and "Firefighting Capabilities" were considered moderate criteria and could score between 0-1. Other criteria were deemed as lower significance and could be scored between 0-0.5. Criteria weightings for all metrics analyzed are described below.

The criteria and rating system was reviewed by MDOT prior to the evaluation process. The following sections summarize each of the evaluated criteria.

6.5.1 Electrical Capacity

This criterion considered "Does the airport currently have sufficient capacity to support increased electrical demand or short-term ability to increase electrical capacity?" Without electrical capacity, the construction of the multimodal charging station would not be justifiable without major electrical infrastructure modifications to bring additional power from the utility supplier.

This criterion was considered high-priority, and the following scores were given:

- Airports with known capacity to handle the estimated electrical demand to support a multimodal charging facility were scored 2.
- Airports with unknown capacity or those that can bring in short term capacity to handle a multimodal charging station were scored 1.
- Airports without current capacity or a short-term solution to acquire more electrical capacity were scored a 0.

6.5.2 Connectivity to Other Airports with Electric Aircraft

This criterion considered "Does the airport have network connectivity (i.e., accessibility to AAM networks outside of Michigan)?" Without connectivity to airports able to charge electric aircraft, the construction of the multimodal charging station would not be justifiable since there would be no location to fly.

A distance of 250 nautical miles (nmi) for a safe flight was discussed with electric aircraft manufacturers and the map provided in Appendix F was used to determine which airports were within 250 nm range for connection to out of state airports with electric aircraft capabilities.

This criterion was considered high priority, and the following scores were given:

- Airports with a 250 nmi range for connection to airports with electric aircraft were scored a 2.
- Airports with partial connection were scored a 1.
- Airports with minimal out of state connections were scored a 0.

Source: Getty Images

6.5.3 Social Equity

This criterion considered "Is the airport located in an Environmental Justice (EJ) or Disadvantaged Area that could benefit from economic development?" Social equity was an integral component of the selection process. It is the understanding of the research team that a multimodal charging station may assist the economic growth/development of an area, while reducing aircraft emissions, and providing a potentially lower aircraft noise level.

Section 7 provides further details on importance of social equity, while Appendix G includes an Equity Analysis Report developed for the six short-listed airports. Rankings were based on the equity analysis performed for a radius of 3-miles surrounding an airport. This criterion was considered high priority and the areas with the lowest to highest disadvantaged area rank were scored from 0-2, compared to other airports in the category.

6.5.4 Electrical Redundancy

This criterion considered "Does the airport have its own utility loop?" An airport loop provides electrical redundancy, which is important in selection if the main source of power is interrupted. Redundancy is important in selecting an airport to support the Multimodal Charging system and a medium scoring weight was given to this criterion.

The following scores were given:

- Airports with utility loop for redundancy to handle potential outages were scored a 1.
- Airports with redundancy of two or more services with capacity to handle the additional load were scored a 0.5.
- Airports with limited or unknown capacity to handle a multimodal charging station were scored a 0.

6.5.5 Firefighting Capabilities

This criterion considered "Does the airport have Aircraft Rescue and Firefighting (ARFF)?" The onset of EVs, buses, and other electrified vehicles and aircraft has raised the concern over exacerbated fires. An EV battery fire requires a significantly larger quantity of water for extinguishing than that of fires from petroleum powered engines. It is estimated that an EV battery fire will require approximately 1,000 gallons of water for extinguishing. The need for firefighting capabilities was deemed important due to the potential of battery fires during charging.

A medium scoring weight was given to this criterion and the following scores were given:

- Airports with a dedicated ARFF facility on site were scored a 1.
- Airports with a nearby fire station were scored a 0.5.

6.5.6 Weather

This criterion considered "How can weather affect the use of electric aircraft?" Discussions with aircraft manufacturers stressed the importance of weather in selecting the initial sites for electric aircraft deployment. They suggested that south and east of Michigan provides better weather for electric aircraft. Since this was an evaluation between Michigan airports, a known differentiator in weather is the seasonal limitations for permanent seeding on MDOT infrastructure projects, which is divided at the north boundary of Township 20.

A low scoring weight was given to this criterion and the following scores were given:

- Airports located in the Southern Lower Peninsula (south of the north boundary of Township 20) were scored a 0.5.
- Airports located in the Northern Lower Peninsula (north of the north boundary of Township 20) were scored a 0.

6.5.7 Environmental Concerns

This criterion considered "Does airport property have any known environmental concerns?" Environmental concerns can limit development or significantly slow the approval process. A minimal scoring rating was assumed for this criterion. Section 7 provides the general effect of climate change and environmental concerns.

A low scoring weight was given to this criterion and the following scores were given:

- Airports without any environmental concerns were scored a 0.5.
- Airports with environmental concerns were scored a 0.

6.5.8 Sustainability

This criterion considered "Are sustainable power sources being used currently (i.e. solar)?" It is important that the airport be sustainable and generates renewable power to support its operations. The existing use of sustainable power sources was viewed favorably to assist in the electrical needs of the multimodal station by reducing demand from the grid.

A low scoring weight was given to this criterion and the following scores were given:

- Airports with sustainable power were scored a 0.5.
- Airports without sustainable power were scored a 0.

6.5.9 Funding

This criterion considered "Is the airport pursuing funding opportunities?" Although the research into the viability of a multimodal charging station is being funded by MDOT, the past research into potential alternative funding of electrification project was deemed important to potentially assist in offsetting the cost of the project.

A low scoring weight was given to this criterion and the following scores were given:

- Airports pursuing funding were scored a 0.5.
- Airports not actively pursuing funding were scored a 0.

6.5.10 AAM Connections

This criterion considered "Has the airport connected with AAM companies?" Like funding, a connection with an existing AAM company was viewed as important, as these airports would likely be the first to have electric aircraft destined for this airport.

A low scoring weight was given to this criterion and the following scores were given:

- Airports pursuing AAM were given a score of 0.5.
- Airports not pursuing AAM were given a score of 0.

6.5.11 Availability of Cargo

This criterion considered "Is the airport handling cargo?" The initial electric aircraft will likely carry cargo rather than passengers. Therefore, the availability of a cargo hangar was deemed important in the selection of the location for the multimodal charging station.

A low scoring weight was given to this criterion and the following scores were given:

- Airports that currently handle cargo were given a score of 0.5.
- Airports that do not handle cargo were given a score of 0.

6.5.12 Availability of Amenities

This criterion considered "Does the airport offer amenities?" Amenities were considered important to offer those driving EVs and using electric aircraft services. These amenities could vary from restrooms, food services, or rental cars.

A low scoring weight was given to this criterion and the following scores were given:

- Airports that offer amenities were given a score of 0.5. Based on each of the six short-listed airports having some type of amenity, each airport scored received 0.5 points.
- Airports that do not offer amenities were given a score of 0. None of the airports analyzed did not offer amenities.

6.5.13 Runway Length

This criterion considered "Does the airport have sufficient runway length?" There has been a concern that if electric aircraft could not access the airport, having a runway length of at least 3,800 feet would allow for a backup fuel powered aircraft to be used.

A low scoring weight was given to this criterion and the following scores were given:

- Airports with runway length(s) greater than 3,800 feet given a 0.5.
- Airports with runway length(s) of less than 3,800 feet given a score of 0.

6.5.14 Criteria Conclusion

The criteria discussed above were used to fairly evaluate whether the short-listed airports in this study were suitable for siting a multimodal facility. It should be noted that there were other criteria discussed, such as whether the airport has current EV charging capabilities, public transportation, or if there is economic cost variation between locations. However, these criteria were determined to have no effect on the selection process.

After the scoring process was complete, each airport was given the opportunity to view their initial scores and provide feedback to the research team. Upon review of the airports recommended adjustments, the scoring matrix was finalized.

6.6 Selection of Airport for Multimodal Station

Applicable criteria were reviewed and a scoring matrix was created to evaluate each short-listed airports' suitability for the multimodal site. Airports were scored based on their previous survey answers, site visit, and information supplied. Scores from the site visits took into consideration the current electrical capacity at the airport and short-term ability to increase this capacity, social equity, connectivity to AAM networks outside of Michigan, sustainable power generation, amenities offered, and suitability of potential locations.

The project team rated each of the six final airports based on this scoring criteria and then confirmed with representatives for each airport to ensure the accuracy of the data. Additionally, airport representatives were permitted the opportunity to contest the scoring or to provide feedback. The airports were not permitted

to view each other's scoring, only the scores for their own airport across the 13 criteria. The final scoring is reflected in Appendix H, with the final ranking and scores summarized below in Table 6.2:

Table 6.2 – Short-List Airports – Final Ranking & Scores

Airport	Airport Code	Airport Type	Scoring
Capital Region International Airport	LAN	Primary – Non-Hub	11
Gerald R. Ford International Airport	GRR	Primary – Small Hub	9
Willow Run Airport	YIP	General Aviation	8.5
Cherry Capital – Traverse City Airport	TVC	Primary – Non-Hub	7
Battle Creek Executive Airport at Kellogg Field	BTL	General Aviation	7
Ann Arbor Municipal Airport	ARB	General Aviation	6

6.7 Conclusion

Based upon the outputs from the MDOT Multimodal Charging Station Decision Matrix, LAN was recommended for further study for the implementation of a multimodal charging station. LAN was the highest ranked airport for a deployment of an airport multimodal charging station with a score of 11 out of a maximum of 12. LAN had the highest score by approximately 18% over the next highest score. It is believed that LAN has the necessary power capacity; is located within an area accessible to other airports that are destinations for electric aircraft; and has placed a considerable focus on electric aircraft charging. A technical memorandum describing the selection process and the selection of LAN is provided in Appendix I.

Section 7

Economic, Environmental and Social Considerations

This section expands on how electrification of aircraft could impact the economic, environmental, and social setting in a community. AAM technologies are rapidly advancing to market. These systems promise to deliver economic benefits to Michigan and other regions where they are being developed, tested, manufactured, or introduced as part of an efficient new form of air transport. The exact nature and magnitude of economic benefits are not fully understood at this early stage of the industry's advancement – factors including regulatory status, technological and infrastructure limitations, and the extended timeframe for widespread adoption contribute to uncertainty about the roles AAM will hold in our future economy. As with other transportation systems and industries, the benefits of AAM will not be experienced uniformly – individual communities and regions will employ AAM technologies in a manner that suits their mobility needs and economic context. There are a number of reports devoted to projecting the economic benefits of AAM and eVTOL deployment, with common themes emerging around the types of benefit and key considerations at play.

Environmental considerations include the effect of climate change on the state of Michigan as well as the environmental aspects involving regulatory approvals to site a multimodal charging station at an airport. Climate change is caused by the increase in greenhouse gases in the atmosphere causing an overall warming of the planet that results when the atmosphere traps heat radiating from Earth toward space. The principle greenhouse gas, carbon dioxide, is released through natural processes (like volcanic eruptions) and through human activities, such as burning fossil fuels and deforestation. Through electrification, including aircraft and vehicles, there are no emissions associated with these sources (except emissions associated with the generation of electricity). The regulatory approval process, including environmental considerations, is detailed in Section 10.

Social considerations include the nature of the surrounding community of the airport where electric aircraft will be utilized. The decision to place charging infrastructure in a predominantly disadvantaged community can be interpreted in contrasting ways, each with its own set of potential benefits and drawbacks. On one hand, siting in a disadvantaged area is seen as a positive step, addressing transportation equity, fostering accessibility in regions that lack sustainable resources and potential positive community impact through job creation and local economic development. Conversely, placing the equipment in an economically advantaged area has its own merits, including higher adoption rates, enhanced financial viability, and improved infrastructure readiness. However, this approach may raise equity concerns, miss opportunities for positive impact in disadvantaged communities, and be negatively perceived by the broader public. For this report, since infrastructure would already be present at an airport, the location of the initial multimodal charging station at an airport near a disadvantaged area was viewed as a positive to foster potential economic growth with addition of electric aircraft generally reducing noise.

7.1 Economic Impacts

Michigan has a rich history in automotive and other manufacturing, and has the potential to leverage its industrial expertise, skilled workforce, and robust supply chain to expand the state's aerospace manufacturing industry. Michigan's educational and research institutions are involved in developing aerospace technologies with AAM and eVTOL applications. Collaborations between industry, academia, and government support aerospace growth and contribute to state and regional economic development strategies.

AAM presents an emerging aerospace sector with strong growth potential as technologies are adopted and will advance to scale in response to demand. Original equipment manufacturers (OEMs) and supply chain operators in the AAM space include a mix of established, legacy aerospace companies and emerging (often smaller) companies. Product design and development remain a focus of eVTOL manufacturing, such as research and development (R&D), testing, regulatory approvals, and scalable production capacity stand among the current priorities. This manufacturing sector will require an extensive supply chain with multiple tiers of suppliers producing and assembling the parts and specialized components used to build aircraft.

Notably, AAM and eVTOL-related manufacturing and supply chains extend well beyond the production of aircraft. Charging equipment, electrical systems, radar and safety systems, site and transportation infrastructure, and repair & maintenance operations are integral to the industry. Design, manufacturing, installation, and ongoing services associated with these products and services are linked to significant economic benefit. EVTOL-related R&D activity has been ongoing and elsewhere for years or even decades as an extension of aerospace and defense industry activity. More recently, capital inflows and the rate of AAM product development have accelerated as AAM is considered a viable industry with market applications in the near future. AAM testing is critical to evaluate commercial readiness for both the transportation of cargo and passengers. Critical readiness factors include:

- Flight testing – Assessing aircraft performance.
- Systems testing – Evaluation of onboard navigation, communication, and other systems.
- Safety and compliance testing – Aircraft safety as well as radar-based tracking and air traffic control systems
- Environmental testing – Noise and other environmental testing

Testing processes, locations, and facilities are largely in place for products under development by AAM industry operators. Testing requirements and processes will remain important as the industry moves forward. Industry testing will extend to the real-world operating environments, with early-adopting regions likely to serve as venues for R&D and testing partnerships.

The eVTOL services are expected to operate at a regional scale for the foreseeable future, meaning that they will generally be used to connect destinations and communities within and surrounding a metropolitan region. As currently envisioned, eVTOL networks are not likely to affect longer-range (i.e., between major metropolitan regions) air service opportunities. Early generations of eVTOL aircraft have range limitations – aircraft currently seeking FAA certification have a range of approximately 250 nautical miles (nmi) on a single charge. Accordingly, the role of these eVTOL aircraft will be to connect nearby communities efficiently and rapidly within a regional network.

On-airport vertiport facilities and AAM service can potentially enhance the passenger experience by providing air travel connections between a commercial airport and destinations within the region. In other words, arriving passengers may use an on-airport AAM connection to rapidly travel to their ultimate destination by air

instead of ground transportation; departing passengers may use AAM for rapid inbound travel to the airport. "Micro-destinations" such as large corporate offices, business parks, or population centers will be accessible via eVTOL passenger transport, presenting an expanded air service opportunity at the community or regional level.

This application will require widespread adoption of AAM as a mode of travel, along with the establishment of a vertiport network to serve destinations and communities throughout a region. AAM network buildout will occur over an extended timeframe, with the timing depending in large part on market demand – which in turn depends on the cost profile and region- and location-specific factors such as population, acceptance, travel patterns, and others.

eVTOL transport presents a new means of delivering cargo and air travel at the regional or community scale. Expected transport roles include the following:

- Cargo services
- Air taxi and airport shuttle services
- Inter-community and inter-city transfer of goods
- "Air metro" systems
- Medical and emergency services
- Business delivery and transportation
- Attraction-and destination-oriented services

Cost feasibility is a major factor in the introduction of AAM networks and services listed above. The cost of the shipment of goods or passenger travel must be comprabable to existing ground transportation options. Technological advancements are expected to increase the capacity of eVTOL aircraft at a reduced cost per mile. As the AAM cost profile decreases over time, its cost feasibility will improve relative to ground systems.

High-density areas offer a robust population base and built-environment conducive to AAM network deployment and operations. A network's utility and consumer appeal depend on the number of vertiport and charging nodes providing access and travel options to and from regional destinations. In other words, access-related benefits are directly and positively related to the network's strength and coverage.

AAM and eVTOL technologies could provide economic benefits to Michigan communities and regions as electric aircraft services are introduced. The magnitude of these benefits is determined by rates of utilization, which reflect the cost feasibility of AAM relative to ground transport. While the timing of widespread adoption is uncertain, early adopting regions are positioned to play roles that will influence the direction of this emerging industry.

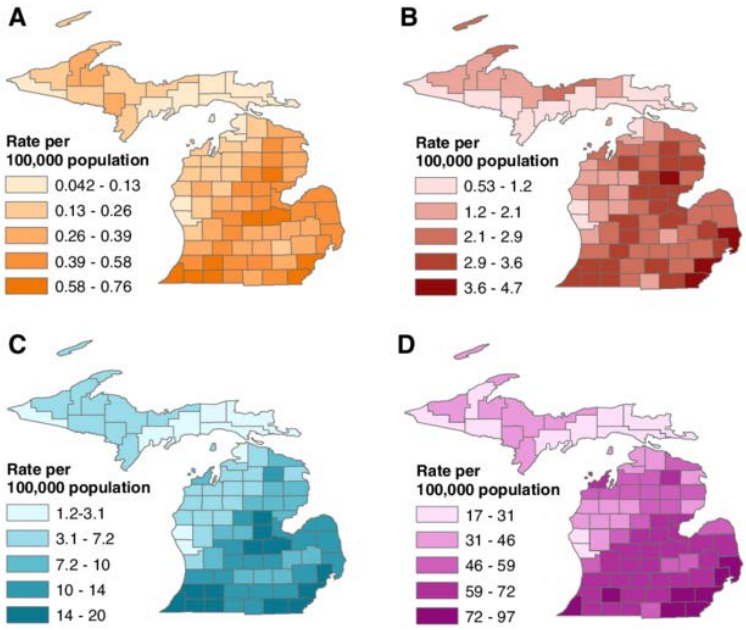
As part of the evaluation, it is believed that the economic factors associated with the deployment of a multimodal charging station would not change based on the location of the station.

7.2 Environmental Impacts

Michigan has been impacted by climate change. With its proximity to large bodies of water, the state is already experiencing climate change impacts including record flooding, severe storm events and high heat. The health burden associated with extreme heat (EH) and extreme precipitation (EP) is expected to rise significantly for Michigan counties with the greatest possibility of extreme weather-related mortalities in the southeast part of the state. In a study examining the burden of selected disease attributable to extreme heat and precipitation, it is estimated that the rate of non-accidental mortality associated with EH would increase from 0.46 per

100,000 adults (33 deaths annually statewide) to 2.9 per 100,000 adults (240 deaths annually statewide) with noted EH concentrations in southeast part of the state (see Figure 7.1). An increase in EH days from 5 to 15 more days annually is estimated for Michigan's lower peninsula with temperatures above 90 degrees F.

Figure 7.1 – Michigan Annual EH Mortality Rates



Annual heat-attributable mortality rate 1971-2000 (a) and 2041-2070 (b) and heat-attributable emergency department (ED) visit rate 1971-2000 (c) and 2041-2070 (d) by county.

Source: ResearchGate

Another primary impact of climate change is the water level rise within Lake Michigan and the increase of flooding events. Within the state, especially in the Detroit area, communities have spent more days under water annually. In a study by Chenfu Huang and colleagues, addressing the association between wave climate and changing water level and ice cover, in contrast from the period of 1999-2013 to 2014-2020, wave heights have increased in most regions. In addition, the increases in wave heights during the period of 2014-2020 were consistent across the ice season, ice-free season, and annual average, showing an apparent increase in wave heights that were well aligned with rapid water level rise.

Environmental impacts can also play a major role in the successful implementation of a project with regulatory reviews such as National Environmental Protection Act (NEPA) process playing a role in Federal decision-making. Section 10 outlines the regulatory approval process, including environmental impacts.

As part of the evaluation, known environmental concerns associated with the six short-listed airports were researched to determine effects on potential deployment of a multimodal charging system. If present, environmental concerns could limit development due to either potential contamination or presence of a significant impact. The six airports were evaluated utilizing the following environmental mapping tools:

- U.S. Fish & Wildlife Service, The National Wetlands Inventory (NWI)- utilized for a review of wetlands or other waters of the U.S. on airport property.
- Michigan EGLE Environmental Assistance Center Coastal Zone Boundary Maps- utilized for a review of each airport in relation to a given coastal zone.
- USEPA NEPAssist Mapper- utilized for a review of toxic releases (TRI), superfund sites (NPL), brownfields (ACRES), surface waters, floodplains, and historic places.

- U.S. Fish & Wildlife Service, Information, Planning, and Conservation (IPaC) System– The United States Fish and Wildlife Service (USFWS) utilizes the Information, Planning and Conservation (IPaC) system as a tool for streamlining the environmental review process. The IPaC system provides a species list that identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat that may occur within the boundary of the study area and/or may be affected by the proposed project.

It is believed that there will be similar impacts across airports in the areas of natural resources, energy, air quality, and noise. The environmental concerns analysis, provided in Section 6.5.7, focused on wetlands, coastal zones, Toxic Release Inventory (TRI), National Priorities List (NPL), and Assessment, Cleanup, and Redevelopment Exchange System (ACRES) sites, surface waters, floodplains, historic places, and threatened, endangered, proposed and candidate species. The properties associated with the short-listed airports had various environmental concerns and were given similar scores in the scoring matrix.

7.3 Social Equity Analysis

A social equity screening was conducted by cross referencing granular data from the EPA's Environmental Justice Screening and Mapping Tool (EJ Screen) and additional screenshots from MiEJScreen, an interactive screening tool that identifies Michigan communities that may be disproportionately impacted by environmental hazards. The equity screening used a 3-mile radius around each of the six shortlisted airports and included data for various pollution sources, critical service gaps, and climate, health, and socioeconomic indicators. The EPA's EJ Screen tool, which is specifically designed to identify communities that may be disproportionately burdened by environmental pollution and other hazards. It helps analyze and visualize data related to environmental and demographic factors, allowing users to identify areas with a higher likelihood of environmental justice concerns. These factors include air and water quality, demographic characteristics, socioeconomic status, and potential environmental hazards.

The complete analysis is provided in a separate report, entitled Equity Analysis Report, which is provided in Appendix G. Based on the completed equity analysis, the airports have been ranked from least disadvantaged to most disadvantaged:

1st Ann Arbor Municipal and Gerald R. Ford International (least disadvantaged)
2nd Cherry Capitol
3rd Battle Creek Executive
4th Capitol Region International
5th Willow Run (most disadvantaged)

The decision to place charging infrastructure in a predominantly disadvantaged community can be interpreted in contrasting ways, each with its own set of potential benefits and drawbacks. On one hand, siting in a disadvantaged area is seen as a positive step, addressing transportation equity and fostering accessibility in regions that lack sustainable resources. The potential benefits include positive community impact through job creation and local economic development, alignment with environmental justice principles, and a commitment to community engagement. On the other hand, challenges such as infrastructure limitations, lower adoption rates of electric vehicles, and concerns about financial viability may arise. Conversely, placing the equipment in an economically advantaged area has its own merits, including higher adoption rates, enhanced financial viability, and improved infrastructure readiness. However, this approach may raise equity concerns, miss opportunities for positive impact in disadvantaged communities, and be negatively perceived by the broader public. In reality, the situation likely resides in a grey area, necessitating a careful consideration of both perspectives to strike a balance that acknowledges and addresses the complex interplay of equity, economic factors, and

environmental justice. The following identifies potential benefits as well as drawbacks of placing the initial multimodal charging station in a higher disadvantaged area compared to a lower disadvantaged area:

Potential benefits:

- **Equity and Accessibility:** Addresses transportation equity by providing sustainable infrastructure in areas that may have limited access to such resources and increases mode choice and mobility options.
- **Community Impact:** Positively impacts the community by creating job opportunities and contributing to local economic development.
- **Community Engagement:** Demonstrates a commitment to community engagement and empowerment by involving residents in the decision-making process.

Potential Drawbacks:

- Infrastructure Challenges: Disadvantaged areas may face infrastructure challenges, such as outdated grids, which could pose difficulties for installing and maintaining charging stations.
- Lower Adoption Rates: Lower adoption rates of electric vehicles in disadvantaged areas may result in un-derutilization of the charging infrastructure.
- Financial Viability: The economic viability of the charging station may be a concern if the area has a lower overall economic capacity.

In general, the research team believes that locating the initial multimodal charging station in a highly disad-vantaged area can potentially serve as an opportunity for growth of the area. Therefore, the social justice, along with electrical capacity, and connectivity to other airports with electric aircraft were the three most significant criteria and received a scoring rating of up to 2 points.

To best maximize social equity in MDOT's siting locations for charging stations in the future, the report, Equity Analysis Report, provided in Appendix G provides a series of recommendations that are proposed to foster a more inclusive and balanced approach.

7.4 Conclusion

As indicated in this section, as the AAM and eVTOL market develops, there are potential economic, environ-mental, and social equity impacts. The conversion to electric aircraft will reduce GHG emissions, the prime contributor to climate change. If an aircraft manufacturer locates in the State of Michigan, there will be potential economic growth and social impacts to the area where the electric aircraft manufacturing facility is located, creating jobs and empowering residents to embrace electric aircraft.

Section 8

Preliminary Design Concept Development and Opinion of Probable Cost

Development of the multimodal charging station concept requires infrastructure, spatial, and operational considerations that are unique to airports. The intent of the design concept is to develop a base model design, which can be scaled to meet the needs of future demand and at a variety of airports on both the airside and landside. Considerations to develop the design were agnostic of location and the full implementation requirements will vary based on each airport. However, the developed concept should be able to be implemented at a variety of locations as long as electrical capacity requirements can be met by the service provider.

8.1 Assessment of Existing Infrastructure

Assessment of existing infrastructure at the candidate airports included review of the survey results provided from the initial survey of airports, information collected from site visits such as preferred locations, and review of any existing electrical and utility documentation provided by the airports. At this stage, the primary consideration is existing electrical capacity, or the ability to provide short-term

Source: Getty Images

capacity to support the multimodal charging station. If capacity is determined to be sufficient, review of each preferred multimodal charging station location relative to the existing infrastructure on the airport was considered for the purposes of implementation.

For example, an airport operating its own medium-voltage distribution loop which has capacity to support this effort and nearby electrical infrastructure such as transformers and switchgear to preferred locations would be a good candidate for implementation of a multimodal charging station. Whereas if locations were remote and would require new utility service, these locations would require comparatively more effort.
The results of the assessment of each airport's existing infrastructure would then be reconciled with capacity requirements for the desired multimodal charging station concept to determine which airports could reasonably support the implementation.

8.2 Overview of Expected Vehicle Types

In general, a multimodal charging station could conceptually include passenger EVs, eVTOL and eCTOL, fleet vehicles, eGSE, and potentially buses. In coordination with MDOT, the expected vehicle types for the implementation of a multimodal charging station were narrowed down to supporting passenger EVs and electric aircraft. On the airside, the electric aircraft chargers would also be able to support electric fleet vehicles if needed by utilizing a compatible charging platform/plug such as CCS-1. On the landside, passenger EVs would be expected to charge utilizing higher capacity Level 2 charging stations (19 kW each) and on the airside electric aircraft (and fleet vehicles) would be expected to charge quickly, utilizing Level 3/DCFC charging.

8.3 Electrical Capacity

The preliminary design was based on supporting two electric aircraft on the airside, and up to four passenger vehicles on the landside. From this, it was determined that two aircraft Level 3 chargers would be required to support airside operations, and two high-capacity Level 2 chargers with power-sharing capabilities (i.e. two charging cables per unit) would be required to support landside demand. Given this and assessing available equipment from manufacturers, it was appropriate to allocate 320 kW for each aircraft charger and 19 kW for each landside charger.

Currently, demand factors for these applications vary. Theoretically all charging stations could be active at full capacity at once. Therefore, for the purposes of understanding electrical capacity requirements at the multimodal station, it was determined to utilize a 100% demand factor for each charger. This means that the total capacity required to support the implementation of the multimodal charging station would need to be the total full rating of the equipment provided. Due to the high loads, it was determined that a 480V, three-phase service would be appropriate for this station. The total minimum capacity required is as follows:

Table 8.1 – Electrical Capacity Calculations

(2) 320 kW aircraft chargers	480V, 3-phase service
(2) 19 kW Level 2 landside EV chargers	Total Service Load (Amps): 678 kW / (480 X √3) = 815 A
Charging Requirements: 678 kW	**Electrical Service Required: 1,000 A**

Standard sizes of electrical distribution equipment typically range from 800A to 1000A. Since the minimum capacity required to support the concept is 815A, the service to the station should be sized at 1000A. The

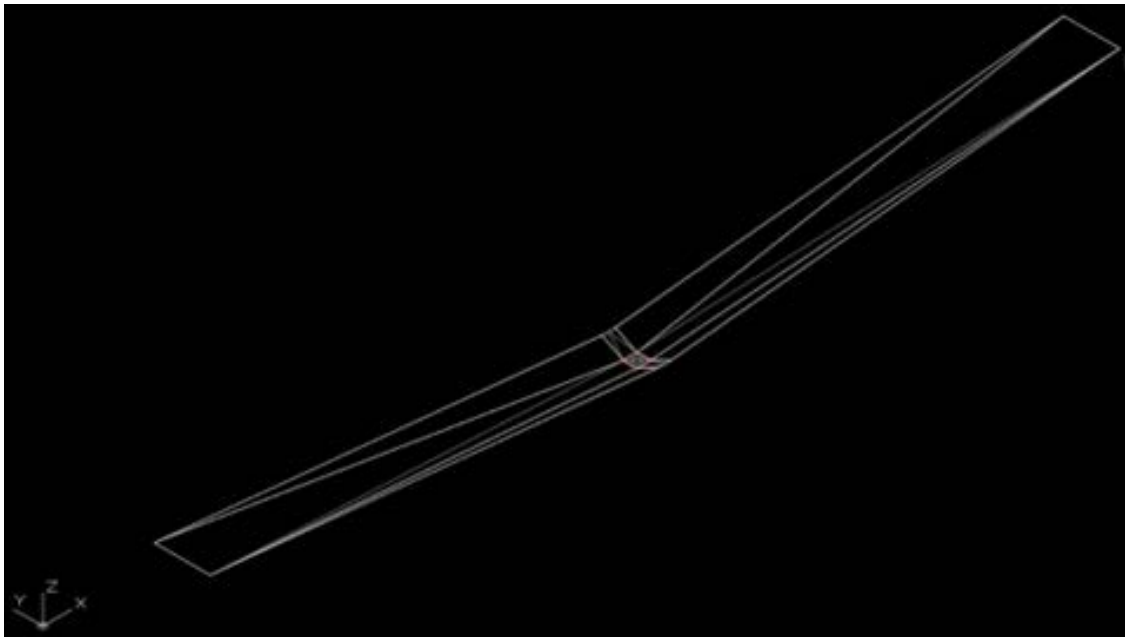
additional capacity, so long as the service equipment is 100% rated, will also allow for expansion of charging capabilities, desired in the future.

8.4 Airport Layout Considerations for Landside and Airside

Location on the airport for a multimodal charging station that incorporates both airside and landside charging must consider a variety of equally important factors. On the landside, in order to provide the public with an accessible charging station, the location must consider access via existing roadways, airside security, and airport traffic. However, the landside accessible location must also be advantageous for air operations on the other side of the fence.

On the airside, location was evaluated to consider landing of eVTOL aircraft as well as taxiing of eVTOL and eCTOL aircraft. Current guidance on eVTOL approach surfaces is limited, but the surface can be evaluated like a helicopter. Due to this, the verticality of the approach surfaces needs to consider if landing areas for eVTOL will be provided at or near the charging station. Figure 8.1 provides three-dimensional conceptual approach surface for eVTOL. Vertical obstructions such as buildings and lighting poles would also need to be considered. For the concept development, it was determined to locate the charging station that is most advantageous to the landside access of vehicles, but appropriately located on existing apron space so that aircraft can taxi to the charging location. This simplifies the location by not requiring the accommodation of vertical takeoff approach surfaces and provides for more available locations on airport property. It is assumed that any vertical takeoff and landing for eVTOL would take place sufficient distance away from the charging station.

Figure 8.1 – eVTOL 3D Conceptual Approach Surface



8.5 Concept Design and Spatial Considerations

Incorporating the findings from the airport surveys, site visits, desired outcomes by MDOT, and reviewing available charging equipment on the market, the concept design incorporated both landside and airside charging from one electrical service to make a multimodal charging station. On the airside, chargers are to be

selected which can charge both aircraft and electric vehicles, while on the landside the public will be able to make use of high-capacity Level 2 chargers for EVs.

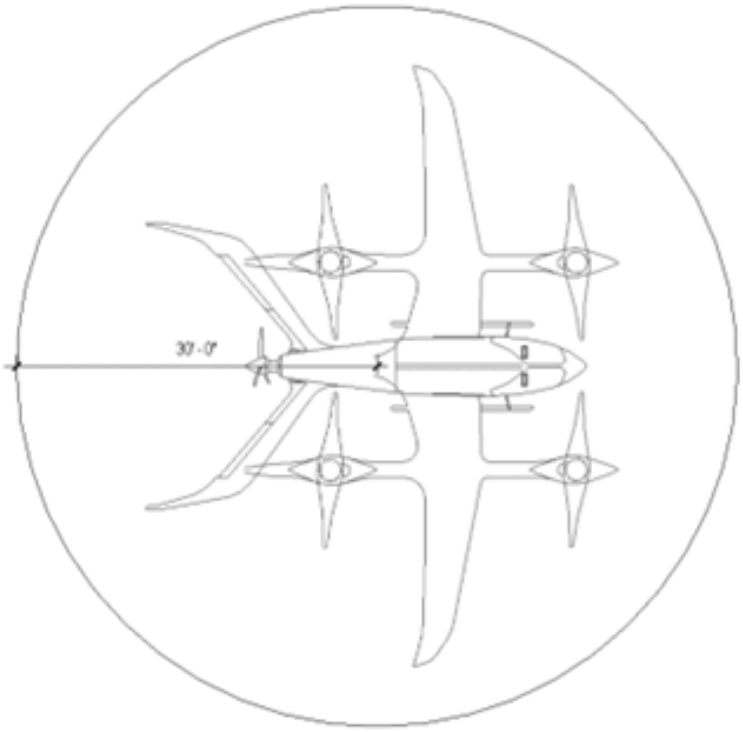
From the utility or airport owned loop, a 750 kVA transformer with 480V secondary will serve all equipment from the landside. For the purposes of cost, we assume that the transformer will be able to be located a maximum of 50 feet away from the distribution panel that will serve the chargers. When reviewing the Opinion of Probable Cost, it is noted that an increase in distance will result in an increase in cost.

After the 750 kVA transformer, a 480V, 1000A rated distribution panel, M-EV, will be installed on an aluminum strut racking system. The rack concept includes a small roof/cover to increase protection from the elements, but the distribution equipment will be rated for outdoor use, at minimum NEMA 3R protection rating. The rack will also hold one enclosure for communications equipment and one enclosure for monitoring equipment. For these systems, 120V power will be required. The concept proposes the addition of a small transformer and a 12-pole, 208Y/120V panel, and small transformer to accommodate this need and any lighting or other lower voltage requirements at the charging location.

From Panel M-EV, the aircraft chargers and landside EV chargers will be powered. Panel M-EV will be required to have networkable, power monitoring devices for each circuit. Power monitoring devices will likely be mounted within the panel or in an adjacent enclosure/cabinet as determined by the manufacturer. For this concept, monitoring devices are called out in an adjacent enclosure. The network cabling will be fed from the communications equipment enclosure also on the rack.

To the chargers on both airside and landside, power cabling will be fed in direct buried Sch. 80 polyvinyl chloride (PVC) conduit to a pull box near each unit. In addition to power cabling, communications cabling will also be provided in separate conduit to each unit and with a dedicated pull box at each unit back to the communications equipment enclosure on the rack. At a minimum, the communications equipment enclosure will contain a fiber patch panel as well as an outdoor rated network switch. Cellular connectivity is not anticipated to be required.

Figure 8.2– BETA ALIA within 30-Foot Radius Area



On the airside, the suggested clear area for the electric aircraft to be parked is based on a minimum 30-foot radius circular area, slightly less than 3,000 square feet (0.06 acres) for each aircraft, as shown in Figure 8.2. As stated earlier, this parking area could land within 30-40 feet away from the charging units, as long as the 50-foot retractable charging cable can reach the aircraft. The parking area will be dependent upon the selected location and coordination with existing movement and non-movement areas of the Air Operations Area (AOA).

Appendix J provides preliminary design of the proposed multimodal airport charging station. The design is intended to be scalable and reproducible. However, final design must consider site specific conditions.

8.6 Opinion of Probable Cost

Based on the concept layout, an opinion of probable cost (Appendix K) was developed to supplement the preliminary design. Bearing in mind assumptions provided on plan and in this report, the opinion of cost aims to provide a rough order of magnitude for project material and installation costs. The unit prices utilized are based upon both Building News BNi Costbooks, published annually, as well as recent costs from related projects internal to C&S, selected based upon the best engineering judgement. It is important to note that this is not a construction cost estimate and does not capture all potential items in a fully developed design. The composition of costs from these sources create a subtotal ("raw cost") to which additional factors are applied.

In order to account for design progression and unknowns, a contingency factor of 15% is typically provided to the opinion of cost at this stage of design. In addition to contingency, an included factor is contractor overhead and profit of 10%. The last factor is the location multiple from the BNi Costbooks. The unit prices provided in the cost book are aligned with national averages. Therefore, the publisher provides location multiples to account for the difference in price for metropolitan areas compared to the national average. According to the Costbook, the highest metropolitan area multiplier in Michigan is Detroit at 1.12, and the lowest shown is Grand Rapids at 0.85. Closer to the median of that data is Lansing at 1.04 – this is the location multiple chosen for this opinion of cost geared towards the median of the range.

Once the subtotal is found, the subtotal is multiplied by the location multiple. The resulting value is then individually multiplied by the contingency factor and the overhead and profit percentage, and the estimated probable cost is the total between the location multiplied subtotal and the two resulting factors.
The resulting opinion of probable cost is approximately $1.08 million. The cost estimate does not include permitting or impact fees, nor does it include potential costs related to optional manufacturer accessory equipment for charging systems which are manufacturer dependent.

Section 9

Charging Costs and Funding Opportunities

Overview

The majority of U.S. airports provide EV charging stations in short-term or long-term parking facilities, usually with no additional charging fee to customers. These airport sponsors have chosen not to collect a fee for EV charging in a pay parking lot because the costs are considered minimal relative to other parking revenues. One sponsor reported that their EV charging costs equated to less than $7 daily, and that the administrative expense of collecting the fee could outweigh the revenue generated. One airport sponsor reported that they were considering implementing a fee of between $1 and $5 per EV charging session if the demand for EV charging continued to grow. Additionally, there is a concern about the perception of "nickel and diming" customers given that EV charging tends to be located in parking lots/garages that already command a premium price. In other sectors, it is common for public EV stations to charge access fees through a given manufacturer's system, such as at the University of California, Los Angeles, where the EV fee for both Level 1 and Level 2 charging stations is $2 per hour.

The charging of electric aircraft when compared to EVs will require significantly more electricity and electric demand to charge aircraft in a short amount of time. It is recommended that MDOT and the selected airport evaluate the electrical load of the proposed chargers in more detail to understand how consumption and demand from the chargers impact the Airport's overall electric bill. For example, demand fees could far exceed the cost of the energy itself, especially for Level 3 fast chargers. The selected airport is advised to consult with the electrical utility on the most favorable rate schedule for its EV chargers. Higher costs for the power may eventually justify charging a fee for use of the EV chargers if one is not already implemented.

This section reviews what Michigan airports have charged for use of eV chargers, an example fee model approach, and potential funding sources to offset the costs of multimodal charging systems.

9.1 Direct Cost Reimbursement for Charging Stations

The most common pathway to revenue generation potential from EV charging is through user-fees charged on either a time or energy per kilowatt-hour (KWh) basis. Frequently, an additional administrative session fee is also charged on top of an hourly or KWh charge. A plug share analysis of EV charging rates at airports in Michigan found that some airports have no fees, while others have a nominal charge. Table 9.1 provides a summary of some example charging fees at Michigan airports:

Table 9.1 – EV Charging Fees at Michigan Airports

Airport	Location	Charging Fee	Application
Detroit Metro Airport (DTW)	Detroit, MI	Free EV Charging with Daily Parking Fee of $26 Per Day	ChargePoint
Grand Rapids Airport (GRR), Short-term Parking Garage	Grand Rapids, MI	Free EV Charging with Daily Parking Fee	EnelX Juicebox
Grand Rapids Airport (GRR), Airplane Viewing Area	Grand Rapids, MI	Free	NEMA 14-50 Plug
Cherry Capital Airport (TVC)	Traverse City, MI	$2.00/hour	ChargePoint

Charging monitoring systems such as Blink and ChargeHub allow for a low-cost way for airports to collect a fee for EV charging. Blink serves as a useful case study for the types of fee models that could be implemented for EV charging. As illustrated in Figure 9.1, Blink provides four charging fee revenue models for consideration at airports.

- Host Owned stations are ideal for airports that want to own, maintain, and operate their own charging infrastructure.
- Hybrid Owned stations require the airport to complete “site preparation” for the charging station with Blink covering the cost of the charger itself as well as maintenance and electricity.
- Blink as a Service is a Blink-specific monthly subscription service with the lowest up-front costs but a higher monthly subscription fee for the airport to receive 100% of revenue.
- Blink Owned is an arrangement wherein Blink provides all installation and site costs, maintenance, equipment, with the airport sharing in a small percentage of charging revenue. This revenue model is approved via Blink on a case-by-case basis.

Figure 9.1 – Blink Charging Business Model

	Host Owned Equipment Purchase Model		**Hybrid Owned** Revenue Shared Model		**Blink as a Service** Monthly Subscription		**Blink Owned** Turn-Key Solution	
	Host	**Blink**	**Host**	**Blink**	**Host**	**Blink**	**Host**	**Blink**
Site Preparation	●		●		●			●
Equipment Cost	●			●		●		●
Charger Installation	●			●		●		●
Electricity	●			●	●			●
Maintenance	●			●		●		●
Network Connectivity Fee	$12-18/month		$12-18/month		Included		$12-18/month	
Subscription Fee					$99-199/month			
Charging Revenue Share	100%	0%	40%	60%	100%	0%	5%	95%

Source: Blink

Table 9.2 provides some representative U.S. airports that have started charging a fee for EV charging in parking facilities through Blink.

Table 9.2 – EV Charging Fees at Various Airports

Airport	Location	Charging Fee
King County International Airport	Seattle, WA	$2 Flat Fee per 24 Hours of Charging
Houston Hobby International Airport	Houston, TX	$0.49 per kWh
El Paso International Airport	El Paso, TX	$0.39 per kWh (Blink Members) $0.49 per kWh (Blink Guests)
Harrisburg International Airport	Middletown, PA	$0.39 per kWh (Blink Members) $0.49 per kWh (Blink Guests)
George Bush Intercontinental Airport	Houston, TX	$0.39 per kWh (Blink Members) $0.49 per kWh (Blink Guests)

Source: PlugShare

Other charging companies may offer different fee models and incentive structures. The inclusion of Blink's fee model is intended to serve as a case study only; it should not be interpreted as a procurement recommendation.

9.2 Grant Funding

As the EV charging network and the electric charging stations for aircraft becomes more wide-spread, funding opportunities to support the development of electric charging should become more readily available. The following provides potential grant opportunities available as of May 2024 and includes an overview, project type, funding amount, project requirements, and expected deadlines for each of the funding opportunities.

9.2.1 Charge Up Michigan Program [11]

Overview: EV Charger Placement project that aims to build infrastructure for fast charging stations in the State of Michigan. This program will provide funding for qualified DC Fast Charger (DCFC) EV charging equipment, site preparation, equipment installation, networking fees, and signage [12].

Application Project Type: Public or private organizations located in Michigan that have demonstrated significant experience installing and maintaining electric vehicle charging stations and have significant presence in Michigan.

Funding Amount: The grant amount will be the lesser of 33.3% of the total cost or a direct match of the amount the electric utility is paying, up to $70,000, and can only be used for eligible EV charging equipment.

Project Requirements: Must be able to host publicly accessible charging stations, fulfill program priorities, and are enrolled in a utility rebate program.

Deadline: The submission window will remain open until all the funds for Phase I are exhausted and future rounds of funding are unknown.

9.2.2 National Electric Vehicle Infrastructure (NEVI) Formula Program

Overview: Provides funding to states to strategically deploy EV charging infrastructure and establish an interconnected network to facilitate data collection, access, and reliability [13].

Application Project Type: EV charging, public transportation charging, infrastructure planning, workforce development.

[11] Charge Up Michigan Program. Accessible at: https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans/charge-up-michigan-program

[12] Mi EGLE. Charge Up Michigan Program. Accessible at: https://www.michigan.gov/egle/about/organization/materials-management/energy/rfps-loans/charge-up-michigan-program Accessed 5/28/2024.

[13] MI EGLE. National Electric Vehicle Infrastructure Formula Program. Accessible at: https://www.michigan.gov/mdot/travel/mobility/initiatives/nevi Accessed 5/28/2024.

Funding Amount: The Federal share of eligible project costs is 80 percent. Private and State funds can be used to provide the remaining cost share. Michigan will receive a total of roughly $110 million in NEVI Formula Program funding through Fiscal Year 2026.

Project Requirements: The NEVI Formula Program Final Rule serves as a guide to Michigan's program development. The State of Michigan has also created a list of NEVI Formula Program Requirements.

9.2.3 Voluntary Airport Low Emissions (VALE) Program

Overview: The FAA VALE program was develped to improve the air quality near an airport as well as provide the opportunity to obtain emission reduction credits for future airport development. Through VALE, airport sponsors can use Airport Improvement Program (AIP) funds and Passenger Facility Charges (PFCs) to finance low emission vehicles, charging stations, gate electrification, and other airport air quality improvements [14].

Application Project Type: Traditionally, VALE funded projects at commercial service airports in a "non-attainment" or "maintenance" area for one of the National Ambient Air Quality Standards (NAAQS) pollutants. Eligible project types include mobile and stationary equipment that reduce on-airport emissions, such as chargers supporting low-emission vehicles and infrastructure upgrades. It should be noted that the FAA Reauthorization Act of 2024 now allows all commercial airports be eligible for VALE funding, regardless of the attainment status of the airport location.

Deadline: Pre-Applications are due to the FAA by November 1st of each year.

9.2.4 Airport Zero Emissions Vehicle (ZEV) and Infrastructure Pilot Program

Overview: The Airport ZEV Program is available to any public-use airport eligible to receive AIP grants in the National Plan of Integrated Airport Systems (NPIAS)[15].

Application Project Type:

- Airport owned, on road, zero emissions vehicles.
- Vehicles that transport airport passenger
- Certain light and heavy-duty trucks may also be eligible for funding.
- Construction or modification of infrastructure to facilitate fuel delivery to funded ZEVs.
- Project Requirements:
- ZEV-funded equipment must remain at the airport for its useful life (and be used exclusively on airport for airport purposes)
- The airport sponsor must track and maintain records of ZEV-funded equipment use.
- The airport sponsor must maintain ZEV-funded equipment in use during the equipment's useful life. This includes replacing damaged or inoperable equipment.

Deadline: Pre-Applications are due November 1st of each year.

[14] FAA. Voluntary Airport Low Emissions Program (VALE). Accessible at: https://www.faa.gov/airports/environmental/vale Accessed 5/28/2024.

[15] FAA. Airport Zero Emissions Vehicle and Infrastructure Pilot Program. Accessible at: https://www.faa.gov/airports/environmental/zero_emissions_vehicles Accessed 5/28/2024.

9.2.5 FAA Reauthorization Act of 2024

The FAA Reauthorization Act of 2024 reauthorizes appropriations to the FAA for fiscal years 2024 through 2028. Section 745 of the Reauthorization Act is the Electric Aircraft Infrastructure Pilot Program, which establishes a five-year pilot program allowing up to 10 eligible airports to acquire, install, and operate charging equipment for electric aircraft and to construct or modify related infrastructure to support such equipment. The details of the pilot program, including cost reimbursement, are unknown at this time.

9.3 Conclusion

There are several potential means that MDOT or an airport can use to recoup some of the capital and operating expenditures for a multimodal electric charging station, whether through charging vehicle and aircraft owners for charger use or via federal and state grants. Reimbursements companies such as Blink can offer a cost per kilowatt charge to the airport, while funding programs for electric charging infrastructure can vary over time. It is important to note that the project requirements for each funding stream since each program is tailored to the specific charging application. In addition, the FAA has established an Electric Aircraft Infrastructure Pilot Program, which potentially could be used to offset the costs of a multimodal charging station.

Section 10

Assessment of Applicable Regulatory & Approval Processes for Deployment

This section summarizes the regulatory requirements and approval process for charging stations and electrical infrastructure improvements at an airport. To incorporate emerging technologies such as electric aircraft with other airport development, airports need to understand how these projects can navigate through the FAA's framework for planning and environmental approvals.

10.1 Planning

10.1.1 ALP "Pen-and-Ink" Change

If charging infrastructure is proposed to be constructed on airport property with new aircraft parking positions, revisions to the currently approved Airport Layout Plan (ALP) would be required. These revisions, called "pen-and-ink" changes, are most commonly minor modifications, and do not represent a major change in the information or conditions depicted on the ALP. Pen-and-ink changes need to be reviewed and approved by the FAA Detroit Airport District Office (ADO), and typically include supporting documentation and an updated drawing depicting the proposed change. If there are no new aircraft positions, the FAA airport District office (ADO) should be consulted on ALP requirements for chargers.

10.1.2 Section 163 Determination

In accordance with FAA Memorandum dated June 22, 2023, Updated Instructions to the ADO and Regional Office of Airports Employees Regarding Airport Layout Plan Reviews and Projects Potentially Affected by Section 163 of the FAA Reauthorization Act of 2018, when an airport submits an ALP change (pen-and-ink change), the FAA must determine whether the proposal is subject to the agency's approval authority, as defined/limited by Section 163. This involves determining if the FAA has ALP approval authority and how the land was acquired. Information needed to assist the FAA in making this determination includes the following:

- A copy of the current approved ALP or draft ALP change (e.g., pen-and-ink change) that identifies the project and its location.
- A copy of the on-airport land use map.
- A copy of the Exhibit A property map, which should include identification of the funding source used for purchase of the property.
- Any supporting deeds or any other conveyance documentation regarding airport ownership of the land the project is located on, including surplus or any other property deeds of conveyance, etc.
- Source(s) of funding for the proposed project.
- A project description of the proposed modification(s) to the airport or its facilities.

If the FAA determines they have ALP approval authority or federal funds were used in the acquisition of property where the proposed charging and electrical infrastructure projects will be located, the environmental review will take place in accordance with the FAA's processes described below. If the FAA determines they do

not retain ALP approval authority and federal funds were not used in the acquisition of property where the proposed project is located, federal requirements will not apply, and environmental reviews would be completed by the agency with approval authority (ex. state or local environmental reviews, if required).

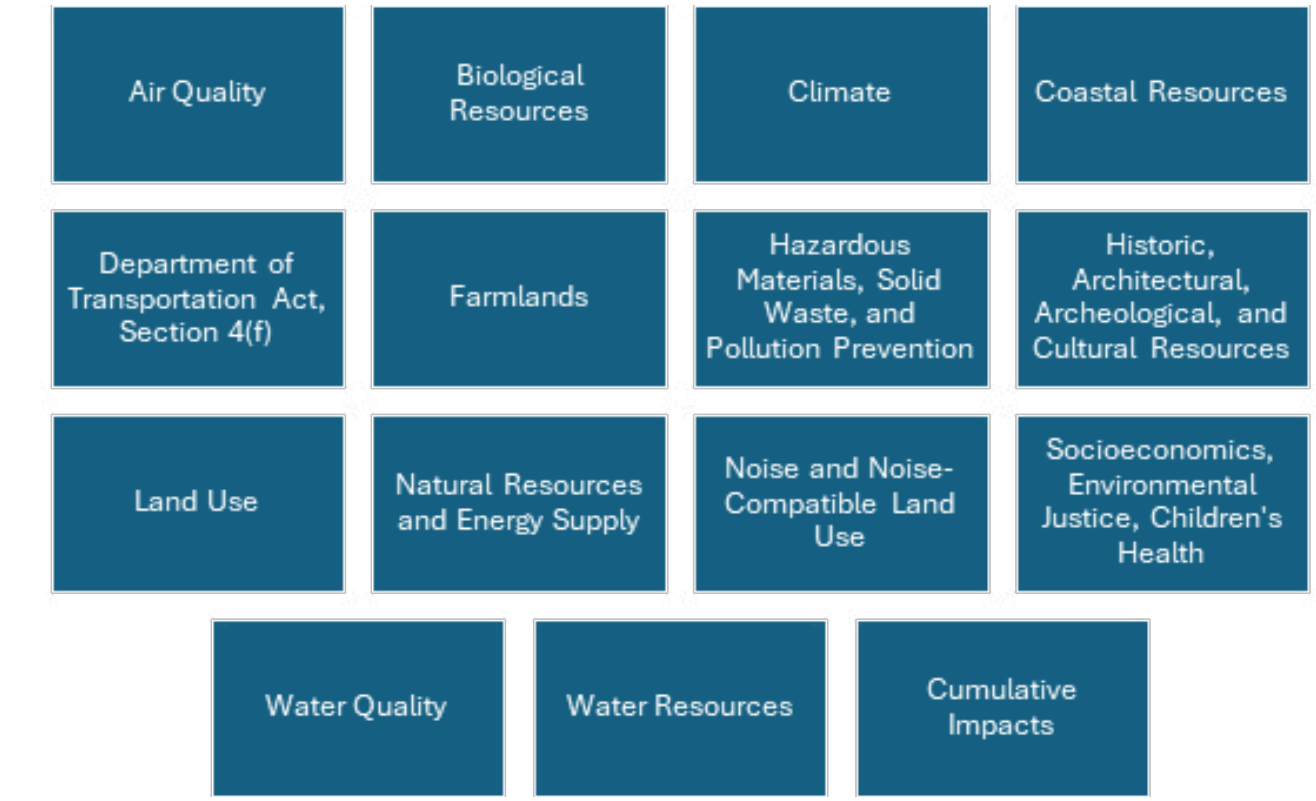
10.2 Environmental

The National Environmental Policy Act (NEPA) of 1969 requires federal agencies to consider environmental effects of proposed actions that may result from a proposed project. Typical federal actions include projects that require federal approvals, receive federal funds, or obtain federal permits. The FAA provides a framework in which to assess environmental effects through the following documents:

- Federal Aviation Administration (FAA) Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions (hereinafter referred to as FAA Order 5050.4B)
- FAA Order 1050.1F, Environmental Policies and Procedures (hereinafter referred to as FAA Order 1050.1F)
- FAA 1050.1F Desk Reference

These documents provide the FAA requirements in which to review specific environmental resource categories and to determine the level of environmental review required for different airport projects. There are several environmental resource categories that must be reviewed for every proposed action, as identified in Figure 10.1.

Figure 10.1 – Environmental Resource Categories



When determining the level of environmental review, the sponsor should consider the affected environment, project scope, and the purpose and need of the project and consult FAA Orders 1050.1F and 5050.4B to determine which of the three levels of environmental review below are appropriate:

- Categorical Exclusion (CATEX)
- Environmental Assessment (EA)
- Environmental Impact Statement (EIS)

10.2.1 Categorical Exclusion (CATEX)

According to FAA Order 1050.1F, a "CATEX refers to a category of actions that do not individually or cumulatively have a significant effect on the human environment, and, for which, therefore, neither an EA nor an EIS is required". FAA Order 1050.1F Section 5-6 provides a list of actions that normally do not individually or cumulatively have a significant effect on the human environment; these actions are also summarized in FAA Order 5050.4B Table 6-2.

The following project elements may apply to the proposed multimodal charging facilities for electric aircraft and vehicles:

- Airfield improvements, aircraft parking areas (build, repair, or extend an existing airport's aprons to accommodate multimodal charging for electric aircraft).
- Purchase and installation of low emission technology equipment and associated infrastructure upgrades.
- Parking areas (build small aircraft parking ramps, vehicular parking areas, etc.).

It is assumed that the above-listed project elements would occur on airport property and would not cause impacts to environmental resource categories. Depending on the scope of the entire project, it is anticipated that elements would be categorically excluded under the following sections of FAA Order 1050.1F:

- Section 5-6.3(b): Establishment, installation, upgrade, or relocation of any of the following on designated airport or FAA property: airfield or approach lighting systems, visual approach aids, beacons, and electrical distribution systems as described in FAA Order 6850.2, Visual Guidance Lighting Systems, and other related facilities.
- Section 5-6.3(g): Replacement or upgrade of power and control cables for existing facilities and equipment, such as airfield or approach lighting systems (ALS), commercial space launch site lighting systems, visual approach aids, beacons, and electrical distribution systems as described in FAA Order 6850.2, Visual Guidance Lighting Systems, or airport surveillance radar (ASR), commercial space launch site surveillance radar, Instrument Landing System (ILS), and Runway Visual Range (RVR).
- Section 5-6.4(e): Federal financial assistance, licensing, or Airport Layout Plan (ALP) approval for the following actions, provided the action would not result in significant erosion or sedimentation, and will not result in a significant noise increase over noise sensitive areas or result in significant impacts on air quality.
  - Construction, repair, reconstruction, resurfacing, extending, strengthening, or widening of a taxiway, apron, loading ramp, or runway safety area (RSA), including an RSA using Engineered Material Arresting System (EMAS); or
  - Reconstruction, resurfacing, extending, strengthening, or widening of an existing runway.
  - This CATEX includes marking, grooving, fillets and jet blast facilities associated with any of the above facilities.
- Section 5-6.4(f): Federal financial assistance, licensing, Airport Layout Plan (ALP) approval, or FAA construction or limited expansion of accessory on-site structures, including storage buildings, garages, hangars, t-hangars, small parking areas, signs, fences, and other essentially similar minor development items.

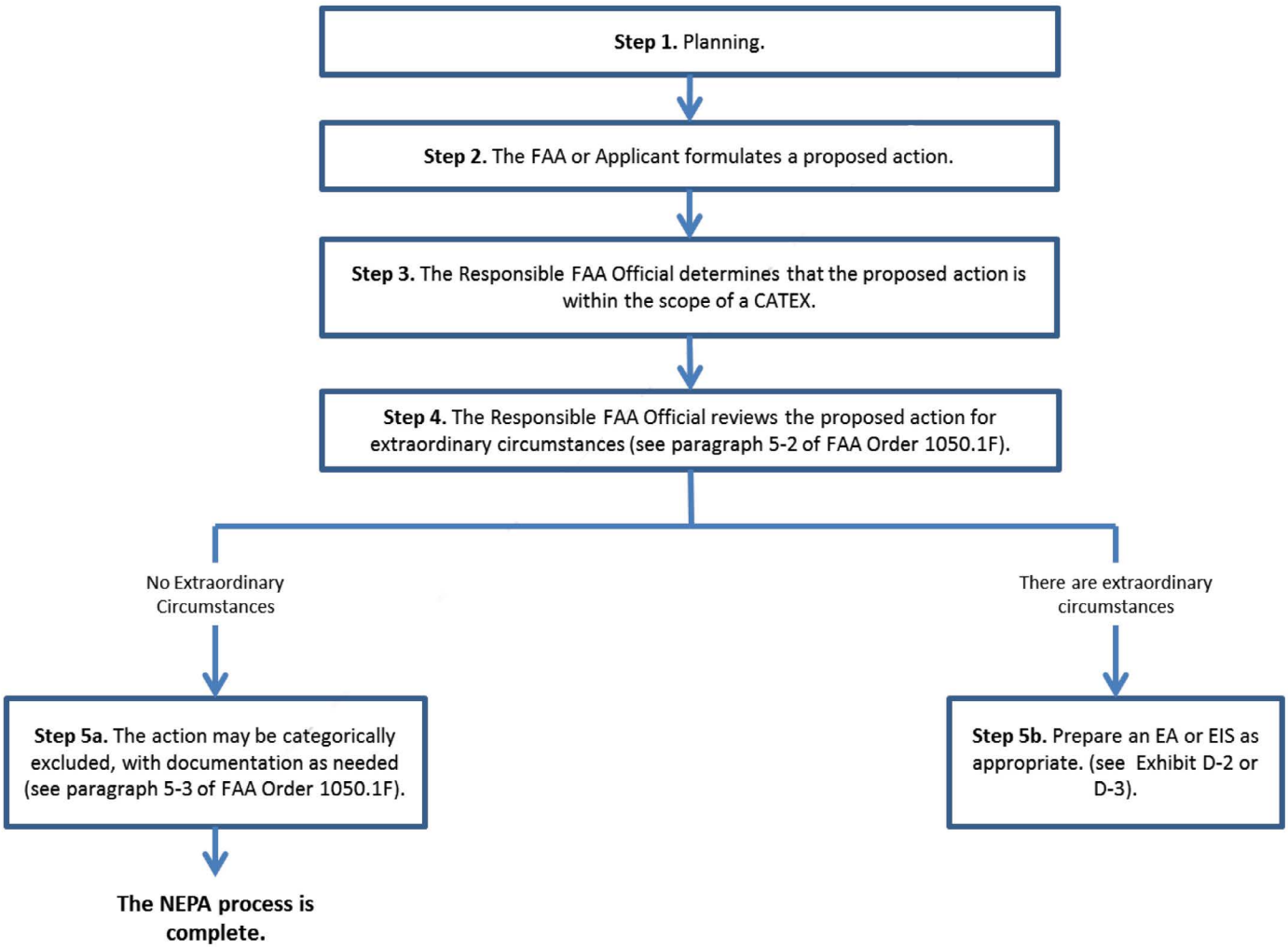
- Section 5-6.4(h): Federal financial assistance, licensing, or Airport Layout Plan (ALP) approval for construction or expansion of facilities—such as terminal passenger handling and parking facilities or cargo buildings, or facilities for non-aeronautical uses at existing airports and commercial space launch sites—that do not substantially expand those facilities.
- Section 5-6.4(n): Minor expansion of facilities, including the addition of equipment such as telecommunications equipment, on an existing facility where no additional land is required, or when expansion is due to remodeling of space in current quarters or existing buildings. Additions may include antennas, concrete pad, and minor trenching for cable.
- Section 5-6.4(aa): Upgrading of building electrical systems or maintenance of existing facilities, such as painting, replacement of siding, roof rehabilitation, resurfacing, or reconstruction of paved areas, and replacement of underground facilities.

When the project scope has been defined and the affected environment understood, the sponsor should coordinate with the Environmental Protection Specialist at the Detroit ADO to confirm the level of NEPA review. Figure 10.2 shows the typical CATEX process, which includes the completion of the FAA's Documented CATEX form. The CATEX process typically take approximately three to four months to be completed.

Figure 10.2 – CATEX Process

Appendix D. National Environmental Policy Act Process Flowcharts

Exhibit D-1. Typical Categorical Exclusion Process

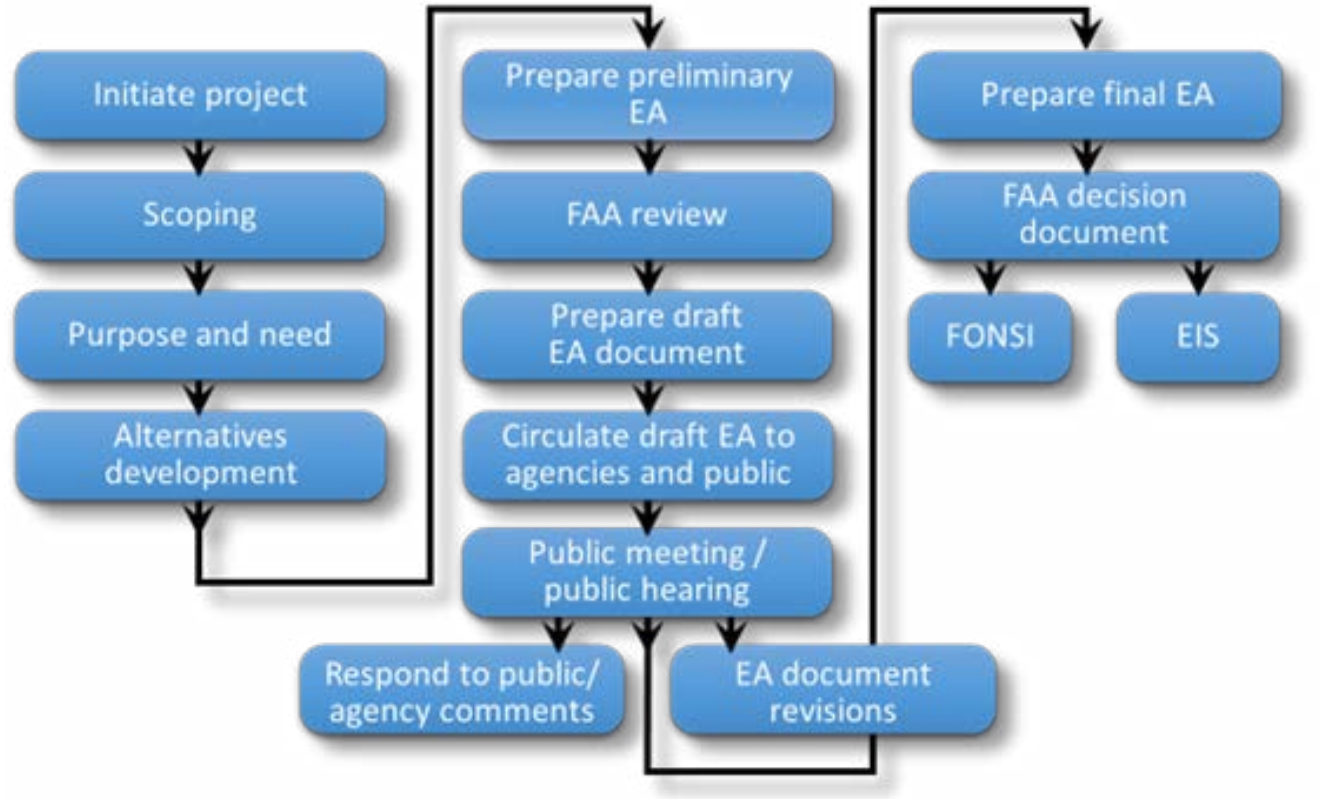


10.2.2 Environmental Assessment

FAA Order 1050.1F defines an environmental assessment (EA) as a *"concise public document that briefly provides sufficient evidence and analysis for determine whether to prepare an EIS or a FONSI"* (Finding of No Significant Impact). FAA Order 1050.1F Chapter 3, Section 3-1.2 identifies actions normally requiring an EA. While the anticipated level of environmental review for the multimodal project is a CATEX, the project could be elevated to an EA if a review of the affected environment identifies the presence of "extraordinary circumstances". FAA Order 1050.1F, Section 5-2 contains a list of extraordinary circumstances, defined as *"factors or circumstances in which a normally categorically excluded action may have a significant environmental impact that then requires further analysis in an EA or an EIS".*

Figure 10.3 shows the typical EA process, which includes preparation of a report document and publishing the draft document for public review and comment. The report must describe the project's purpose and need; evaluate feasible alternatives for development; describe the affected environment; determine the environmental consequences resulting from the project; and identify any required permitting requirements or mitigation measures. The Final EA results in either a FONSI or recommendation to prepare an Environmental Impact Statement (EIS).

Figure 10.3 – EA Process

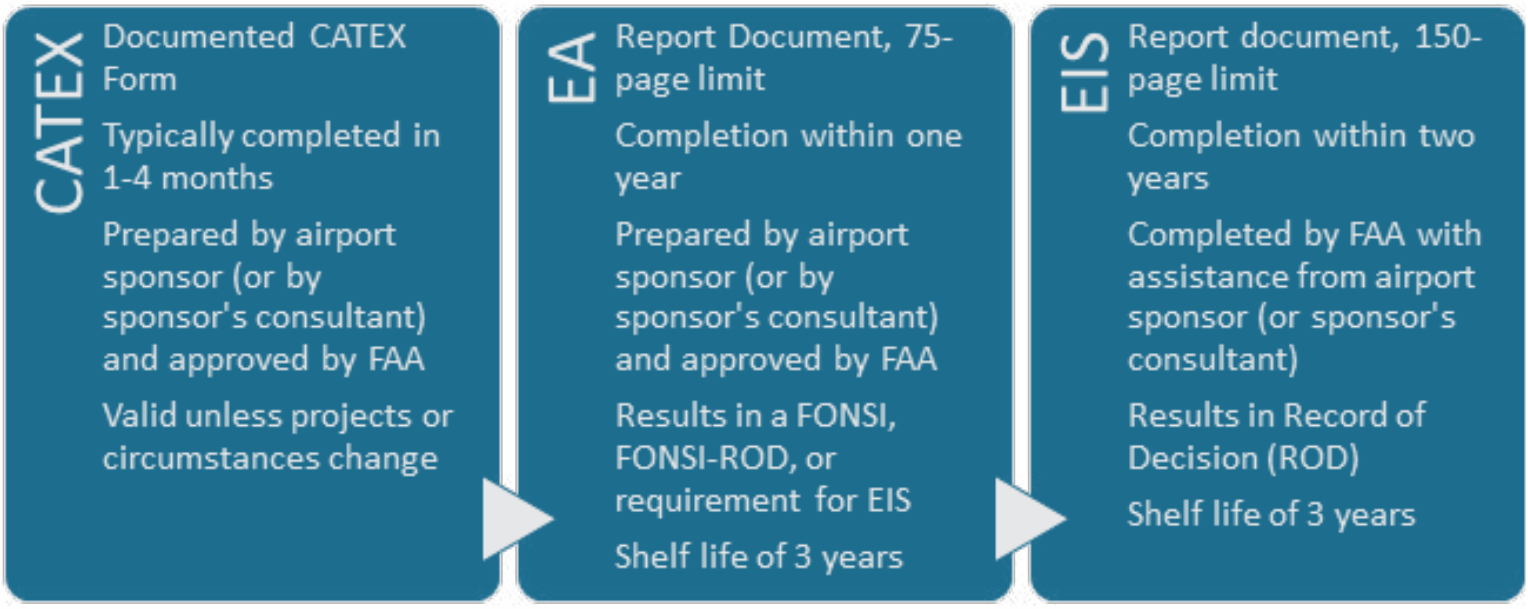


10.2.3 Environmental Impact Statement (EIS)

EISs are required for major Federal actions that significantly affect the quality of the human environment. An EIS is a full disclosure document that details the process through which a transportation project was developed, includes consideration of a range of reasonable alternatives, analyzes the potential impacts resulting from the alternatives, and demonstrates compliance with other applicable environmental laws and executive orders. This level of environmental documentation would not be anticipated for the proposed multimodal charging facilities for electric aircraft and vehicles, unless there were significant impacts that occur off airport property (i.e., significant upgrades or improvements to utility infrastructure). According to CEQ requirements, the EA report document has a page limit of 150 pages (not including appendices) and must be completed within two years.

A summary the keys differences between NEPA documents is shown in Figure 10.4 below.

Figure 10.4 – Requirements for Three Levels of Environmental Review



10.2.4 Conclusion

It is anticipated that electrical infrastructure projects required to support a multimodal charging facility and associated aircraft parking spaces would require FAA approval of an updated ALP (pen-and-ink change) and would subsequently require a CATEX. It is recommended that the airport follow these steps in obtaining approval for the charging infrastructure for electric aircraft:

1. Determine the proposed project scope and identify the footprint of all project elements.
2. Submit the revisions of the ALP (pen-and-ink change) to FAA Detroit ADO for review/approval.
3. Complete the Section 163 Determination Request and submit to FAA Detroit ADO for review/approval.
4. Review the affected environment for environmental resource categories to determine if the project would have extraordinary circumstances.
5. Coordinate with the FAA to confirm the level of environmental review (i.e. CATEX)
6. Prepare the necessary documentation (i.e. CATEX Form).
7. Submit to the FAA Detroit ADO for their review and approval.

Section 11

Recommendations and Implementation Plan

11.1 Project Conclusions

The global transportation system has historically relied on liquid fossil fuels as its energy source. Airports are no different, with petroleum serving as the primary fuel for aircraft, ground support equipment (GSE) and passenger transportation vehicles. With the impact of a changing climate, urban areas not obtaining NAAQS, and the instability in the supply of fossil fuels, electric vehicle technologies have grown rapidly in terms of adoption and the aviation industry is now researching and developing electric aircraft for both urban UAM and RAM short distance trips of less than 250 nmi.

Airports at the same time have been promoting electrification, primarily focusing on gate electrification, preconditioned air (PCA) and charging infrastructure for the use of eGSE. With more electric vehicles being driven by passengers and the onset of electric aircraft, MDOT as well as commercial and GA airports throughout Michigan need to plan for these future realities. Electric vehicles, chargers, and monitoring systems are readily available today, but electric aircraft is still in its infancy. Although manufacturers claim electric aircraft, including eCTOLs and eVTOLs, will be available by 2025, FAA has a four-part certification process prior to operation.

This research project for multimodal airport charging station deployment had two primary objectives:

1. Conduct a feasibility analysis for a multimodal charging station at a Michigan Airport.
2. Provide recommendations on design and implementation of multimodal charging stations.

In order to determine the most appropriate airport to house the initial multimodal charging station, a comprehensive process was utilized to assess and rank the Tier 1 and Tier 2 airports (according to the MASP) within the State of Michigan with publicly available data as well as airport responses to a survey about their current infrastructure and desire to host a multimodal charging system. From this first analysis, six airports were short-listed for a detailed site visit, further evaluation, and ultimately selection for a multimodal station deployment. It should be noted that the short-listed included three GA airports, two primary non-hub airports, and 1 primary small hub airport.

Criteria were identified and weighted to analyze the characteristics of each short-listed airport, with the most important criteria being electrical capacity, ability to connect with airport locations that have or will have electric aircraft, and the social demographics of the surrounding community within 3 miles of the airport. The selection of social equity as an important criterion promotes inclusion to potentially increase the economic growth of the nearby community.

Based on the scoring system developed and analysis of the short-listed airports, Lansing Capital Region International Airport (LAN) was recommended for the implementation of the initial multimodal charging station. LAN was the highest ranked airport for a deployment of an airport multimodal charging station with a score of 11 out of a maximum of 12. It is believed that LAN has the power capacity, located in an area that is classified

as disadvantaged, has access to other airports that are destinations for electric aircraft, supported by AAM operators and manufacturers, and has placed a considerable focus for electric aircraft charging infrastructure.

The preliminary design of a multimodal charging station has the following characteristics:

- Ability to charge 2 electric aircraft and 4 passenger vehicles simultaneously.
- A minimum 30-foot radius parking area for each aircraft
- Charging requirements of 678 kW
- Electrical service of 1,000 A required

A concept plan and the preliminary design of a multimodal charging station is provided in Appendix J. The opinion of probable cost for such a charging station is estimated to be approximately $1.08 million, as detailed in Appendix K.

The ADO should be consulted for electrical infrastructure projects to support electric aircraft whether an updated ALP is required. FAA guidance related to NEPA (FAA Orders 1050.1F and 5050.4B) do not currently refer to electric aircraft currently but upcoming updates are expected to include more details and guidance related to electric aircraft and associated infrastructure.

11.2 Project Recommended Actions

Section 6 details the feasibility analysis that was conducted for Tier 1 and Tier 2 airports, with LAN being selected as the location of the initial multimodal charging station. Based on the research described in this report, the following recommendations are for MDOT and associated Michigan airports as electric aircraft become more prevalent and more passenger vehicles require charging at airports.

1. Evaluate and conduct final design of the initial multimodal charging station at a specific airport. The preliminary design offered in this report is intended to be scalable to easily allow for other airports in Michigan to implement charging infrastructure in a cost-effective manner. Following final design, bid, and construction, the multimodal charging station can serve as an example to other airports about the minimal requirements necessary and potential features available for other future aircraft charging facilities.
2. Continue to work with electric charger and electric aircraft manufacturers to locate a manufacturing location at or near a Michigan airport. The ability to have chargers with the power to support aircraft can be advantageous in siting a manufacturing facility.
3. Inform and promote the construction of aircraft charging capabilities at both GA and commercial airports across the state. Although LAN was selected for locating the initial multimodal charging station, other airports across the state could be additional locations that support electric aircraft.
4. Identify potential funding initiatives within Michigan and the FAA to offset the costs of construction of electrical infrastructure to support electric aircraft, such as the upcoming Electric Aircraft Infrastructure Pilot Program.
5. Work with the FAA, specifically the Detroit ADO, on the approval process for electric aircraft and the requirements for siting and constructing electric infrastructure for increased power demand, chargers, and electric aircraft parking positions.
6. Continue to stay abreast with published research related to the electric aircraft and airports, including ACRP and other FAA funded research.

11.3 Implementation Plan for Deployment of Multimodal Charging Stations

The following table provides an Implementation Plan outlining the recommended next steps. Potential federal and state funding sources have been listed to identify opportunities to offset the capital cost of construction of the initial multimodal charging station and well as future charging infrastructure at airports throughout Michigan.

Michigan Department of Transportation Multimodal Airport Charging Station Deployment Implementation Plan

Task Description
Completion of Final Phase 1 Deployment Report
Construction of initial multimodal charging station
Initiate discussions with FAA Detroit ADO
Airport complete final design
Apply for available funding opportunities
Complete construction of multimodal charging station [1]
Locate a charger or electric aircraft manufacturer in Michigan
Initiate discussions with manufacturers
Initiate discussions with airports and communities
Manufacturer selects Michigan site for manufacturing facility
Promote construction of electric charging infrastructure at other airport
Target two GA airports
Target two primary airports
Research funding opportunities and published research on electric aircraft

1. Schedule is dependent upon delivery time for chargers and electrical infrastructure.

Appendix A:
Initial Survey of Michigan Airports

MDOT Multimodal Airport Charging Station Deployment - Phase I

Initial Airport Survey

The Michigan Department of Transportation (MDOT) has retained the C&S Engineers (C&S) and HoveCon team to perform the research services for Phase 1 of a multimodal airport charging station deployment. A multi-modal charging station will be able to electrify and charge electric aircraft, ground support equipment, ground access and personal vehicles at an airport. The primary objectives of the research is as follows:

- Conduct a feasibility analysis for a multi-modal charging station at a Michigan Airport
- Provide recommendations on design and implementation of multi-modal charging stations

This survey will provide the research team with information for an initial assessment of Tier 1 and Tier 2 airports and their ability to deploy a multimodal charging station. From this initial assessment, five or six airports will be further evaluated with a detailed evaluation. The initial survey is organized into the following areas:

Airport contact information
Airport characteristics
Electrical infrastructure and ability to upgrade
Advance Air Mobility (AAM)
Interest in a Multimodal Electrification

Please contact John Trendowski (jtrendowski@cscos.com) or Kelly Jost (kjost@cscos.com) with any questions.

1. Airport Contact Information:

Name of Airport	
FAA ID	
Tier 1 or Tier 2	
Airport Owner	
Airport Contact Person	
Preferred Email	
Preferred Phone	
Airport Address	

2. Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)

Is ALP current?

Number of enplanements for CY2022

Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft

Planned % Increase/Decrease in Aircraft or Operations (specify time period)

Current Number and Size of Cargo Aircraft

Planned Number and Size of Cargo Aircraft

Total Acreage of the Airport

Any Heliports (list length and width)

Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)

Does the Airport have a military presence?

3. Please upload existing ALP

Choose File Choose File No file chosen

4. Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Choose File Choose File No file chosen

Existing electrical infrastructure and ability to upgrade

5. Name of electricity utility provider?

6. Has an electrical capacity study been undertaken in the last 5 years?

- ◯ Yes
- ◯ No

7. If yes, please provide the results.

Choose File Choose File No file chosen

8. Number of electrical utility services/feeders into Airport?

9. Capacity of each service (if one, what is the capacity of that service)?

10. Current availability of power from electrical service?

11. Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

12. List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Advanced Air Mobility (AAM)

Definition: AAM includes the use of uncrewed aerial system (UAS), electrical vertical take-off and landing (eVTOL), electrical short take-off landing (eSTOL), and hybrid aircraft for transporting passengers and cargo in urban, suburban and rural regions.

13. Any existing AAM occurring at the Airport?

- ◯ Yes
- ◯ No

14. Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

15. Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

- ◯ Yes
- ◯ No

16. Has the AAM infrastructure needs been evaluated?

- ◯ Yes
- ◯ No

Interest in multi-modal electrification

17. Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

- ◯ Yes
- ◯ No

18. Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

- ◯ Yes
- ◯ No

Appendix B:
Michigan Airports Survey Results

Michigan Department of Transportation
Multimodal Airport Charging Station Deployment
Survey Respondents

Name of Airport	FAA ID	Airport Owner	Contact Person
Ann Arbor Municipal Airport	ARB	City of Ann Arbor	Matthew J Kulhanek
Battle Creek Executive Airport at Kellogg Field	KBTL	City of Battle Creek	Phil Kroll
Capital Region International Airport	LAN	Capital Region Airport Authority	Robert Benstein
Cherry Capital Airport	TVC	Northwest Regional Airport Authority	Bob Nelesen
Chippewa County International Airport	CIU	Chippewa County	Tami L. Beseau
Detroit Metro Airport	DTW	Wayne County Airport Authority	John Philbrook
Dickinson County Ford Airport	Kimt	Dickinson County	Tim Howen
Dupont-Lapeer	D95	Mayfield Township	Sandy Swientoniowski
Gerald R Ford International Airport	GRR	Gerald R Ford Internation Airport Authority	Jim Weiler
Grand Haven Memorial Airpark	3GM	City of Grand Haven	Earle Bares
Hillsdale Municipal Airport	JYM	city of Hillsdale	Ginger Moore
Jackson County Airport-Reynolds Field	JXN	Jackson County	Juan Zapata
Kalamazoo/Battle Creek International Airport	AZO	Kalamazoo County	Anton Bjorkman
Livingston County Spencer J. Hardy Airport	KOZW	Livingston County	Mark Johnson
Marshall Brooks Field	KRMY	City of Marshall	Craig Griswold
MBS International Airport	MBS	MBS International Airport Commission	James Canders
Mt. Pleasant Municipal Airport	KMOP	City of Mt. Pleasant	Bill Brickner
Muskegon County Airport	MKG	Muskegon County	Len Efting
Oakland County International Airport	PTK	County of Oakland	Cheryl Bush
Sanderson Field	KANJ	City of Sault Ste Marie	Tom Brown
Sandusky City Airport	Y83	City of Sandusky	Don Johnston
Schoolcraft County Airport	ISQ	Schoolcraft County	Steve Videtich
West Michigan Regional Airport	BIV	West Michigan Regional Airport Authority	Aaron Thelenwood
Willow Run Airport	YIP	Wayne County Airport Authority	John Philbrook

#1

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, June 14, 2023 1:12:28 PM
Last Modified: Wednesday, June 14, 2023 1:18:16 PM
Time Spent: 00:05:47
IP Address: 40.130.127.65

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Livingston County Spencer J. Hardy Airport**
FAA ID	**KOZW**
Tier 1 or Tier 2	**1**
Airport Owner	**Livingston County**
Airport Contact Person	**Mark Johnson**
Preferred Email	**mjohnson@livgov.com**
Preferred Phone	**517.546.6675**
Airport Address	**3399 County Airport Drive, Howell, MI 48855**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**N/A**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**roughly 175 based aircraft**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**steady**
Total Acreage of the Airport	**455**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**County sells the fuel**
Does the Airport have a military presence?	**NO**

Q3

Respondent skipped this question

Please upload existing ALP

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

DTE

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

fed from 2 directions

Q9

Capacity of each service (if one, what is the capacity of that service)?

Primary cable is on the field

Q10

Current availability of power from electrical service?

single and three phase

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

None

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

None -- interested though

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Respondent skipped this question

Q15

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

No

Q16

Has the AAM infrastructure needs been evaluated?

No

Q17

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

No

Q18

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

Yes

#2

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Thursday, June 15, 2023 5:08:09 AM
Last Modified:	Thursday, June 15, 2023 5:11:54 AM
Time Spent:	00:03:44
IP Address:	71.13.53.196

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Mt. Pleasant Municipal Airport**
FAA ID	**KMOP**
Airport Owner	**City of Mt. Pleasant**
Airport Contact Person	**Bill Brickner**
Preferred Email	**bbrickner@mt-pleasant.org**
Preferred Phone	**(989)772-2965**
Airport Address	**5453 E Airport Rd. Mt. Pleasant MI 48858**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**5000**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**20 based, 1 lear jet, 3 twins, 400 jet ops per year**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**No anticipated changes**
Current Number and Size of Cargo Aircraft	**none based but we see emb 120s 8-10 times a year**
Planned Number and Size of Cargo Aircraft	**No planned changes**
Total Acreage of the Airport	**300**
Any Heliports (list length and width)	**None on the field, 2 hospitals within 2 miles have heliports**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**None**
Does the Airport have a military presence?	**National Guard uses the VOR frequently**

Q3

Please upload existing ALP

37-01_ALP_06%20Build%20Area.pdf (1.1MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Consumers Energy

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

14

Q9

Capacity of each service (if one, what is the capacity of that service)?

Respondent skipped this question

Q10

Current availability of power from electrical service?

phase power available

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

Respondent skipped this question

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

None in the 5 year plan

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Working with local university on drone programs

Q15

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

No

Q16

Has the AAM infrastructure needs been evaluated?

No

Q17

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Yes

Q18

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

Yes

#3

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Thursday, June 15, 2023 5:10:07 AM
Last Modified:	Thursday, June 15, 2023 9:19:20 AM
Time Spent:	04:09:13
IP Address:	99.30.30.41

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**James Canders**
FAA ID	**MBS**
Tier 1 or Tier 2	**2**
Airport Owner	**MBS International Airport Commission**
Airport Contact Person	**James Canders**
Preferred Email	**canders@mbsairport.org**
Preferred Phone	**989-695-4027**
Airport Address	**8500 Garfield Rd, Suite 101, Freeland, MI 48623**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Non-hub**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**71,000**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**18 Based Aircraft - 7 SEL, 6 MEL, 5 Jet**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**10-20% annually**
Current Number and Size of Cargo Aircraft	**1-2 daily flights single engine turbine, occasional cargo up to 737-200**
Planned Number and Size of Cargo Aircraft	**Uncertain beyond current operations. There are several industries within the region expanding their operations significantly, though (Dow, Nexteer, SK Siltron, Hemlock Semiconductor)**
Total Acreage of the Airport	**2,457**
Any Heliports (list length and width)	**NA**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**1 - AvFlight Saginaw (FBO)**
Does the Airport have a military presence?	**No**

Q3

Respondent skipped this question

Please upload existing ALP

Q4

Respondent skipped this question

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Q5

Name of electricity utility provider?

Consumers Energy

Q6

No

Has an electrical capacity study been undertaken in the last 5 years?

Q7 **Respondent skipped this question**

If yes, please provide the results.

Q8

Number of electrical utility services/feeders into Airport?

Two substations owned by Consumers

Q9

Capacity of each service (if one, what is the capacity of that service)?

Room to grow to 1/2 megawatt to full megawatt. Consumers would evaluate need for increased capacity based on need. Consumers does not give out hard numbers to users.

Q10

Current availability of power from electrical service?

Consumers works with users to meet demand as needed.

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

None

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Existing airlines may convert GSE, rental cars have expressed interest in electrification.

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Not currently

Q15 Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?	**No**
Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#4

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Friday, June 16, 2023 6:13:27 AM
Last Modified:	Friday, June 16, 2023 6:51:23 AM
Time Spent:	00:37:55
IP Address:	75.128.122.48

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Grand Haven Memorial Airpark**
FAA ID	**3GM**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**City of Grand Haven**
Airport Contact Person	**Earle Bares - Airport Manager**
Preferred Email	**etutek@sbcglobal.net**
Preferred Phone	**616-847-0638**
Airport Address	**16446 Comstock St. Grand Haven, MI 49417**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA - Part of the National Airport System (small- mid size)**
Is ALP current?	**YES**
Number of enplanements for CY2022	**10,000 Operations**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**60+ expected 12,000 operations this year (25-30% turbine)**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**We have experienced about 10% increase each year- over the last 7 years from 24 aircraft on field to 60+, from 5000 gallons of fuel sold to 30,000 gallons**
Current Number and Size of Cargo Aircraft	**no cargo aircraft**
Planned Number and Size of Cargo Aircraft	**perhaps 1 - small twin**
Total Acreage of the Airport	**155**
Any Heliports (list length and width)	**no**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**1 FBO, 1 Flight School, 1 aircraft maintenance, 1 major skydiving operation**
Does the Airport have a military presence?	**Coast Guard routinely uses airport (USCG station in Grand Haven)**

Q3

Please upload existing ALP

70-02-ALP03-LAYOUT%20PLOT%20(1).pdf (1.4MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

National%20Based%20Aircraft%20Inventory%20-%20Airport%20Details.pdf (136.4KB)

Q5

Name of electricity utility provider?

Grand Haven Board of Light and Power

Q6

Has an electrical capacity study been undertaken in the last 5 years?

Yes

Q7 **Respondent skipped this question**

If yes, please provide the results.

Q8

Number of electrical utility services/feeders into Airport?

1 at moment

Q9

Capacity of each service (if one, what is the capacity of that service)?

500 amp

Q10

Current availability of power from electrical service?

Power Line 300 feet

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

-

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Flight training aircraft, perhaps air taxi

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

looking into

Q15 Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?	**No**
Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#5

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Tuesday, June 27, 2023 5:35:49 AM
Last Modified:	Tuesday, June 27, 2023 9:09:48 AM
Time Spent:	03:33:59
IP Address:	174.128.181.228

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Cherry Capital Airport**
FAA ID	**TVC**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**Northwest Regional Airport Authority**
Airport Contact Person	**Bob Nelesen**
Preferred Email	**bob.nelesen@tvcairport.com**
Preferred Phone	**231-947-2250 x106**
Airport Address	**727 Fly Don't Drive, Traverse City, MI 49886**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Non-hub**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**293,877**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**101,106**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**8.91% through 2030**
Current Number and Size of Cargo Aircraft	**Cessna Caravan, Shorts 360, 2022 landed wt 2,458,488 lbs.**
Planned Number and Size of Cargo Aircraft	**3% growth in landed wt**
Total Acreage of the Airport	**1029 acres**
Any Heliports (list length and width)	**n/a**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**(5) Avflight, 45 North, Giving Wings, Northwest Michigan College, Delta 2**
Does the Airport have a military presence?	**US Coast Guard**

Q3

Please upload existing ALP

Pages%20from%20TVC%20ALP_2022-08-19_future.pdf (4.7MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Traverse City Light & Power

Q6

Has an electrical capacity study been undertaken in the last 5 years?

Yes

Q7

If yes, please provide the results.

TVC%20Energy%20Assessment%20and%20Renewable%20Energy%20Roadmap%20-%20Final.pdf (5.5MB)

Q8

Number of electrical utility services/feeders into Airport?

14

Q9

Capacity of each service (if one, what is the capacity of that service)?

120/240, 120/208, 277/480

Q10

Current availability of power from electrical service?

South Terminal Area is on its own power leg, TCLP indicates a lot of capacity available.

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

none at this time, projects proposed

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

(2) existing electric airport maintenance vehicles, additional electric airport maintenance vehicles planned; (4) EV parking spaces, more EV parking spaces planned

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes - programs in place at NMC, existing study location for MDOT "beyond line of sight" AAM operations.

Q15 Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?	**Yes**
Q16 Has the AAM infrastructure needs been evaluated?	**Yes**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#6

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, June 28, 2023 8:05:40 AM
Last Modified: Wednesday, June 28, 2023 9:04:00 AM
Time Spent: 00:58:20
IP Address: 50.201.129.74

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Gerald R Ford International Airport**
FAA ID	**GRR**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**Gerald R Ford Internation Airport Authority**
Airport Contact Person	**Jim Weiler**
Preferred Email	**jweiler@grr.org**
Preferred Phone	**6162336039**
Airport Address	**5500 44th St SE**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Small Hub**
Is ALP current?	**yes**
Number of enplanements for CY2022	**1,745,640**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**70 based aircraft, 74,876 operations**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**increase of 3% per year**
Current Number and Size of Cargo Aircraft	**1-B757, 1-A300, 5-C208**
Planned Number and Size of Cargo Aircraft	**increase of 3% per year**
Total Acreage of the Airport	**3,200**
Any Heliports (list length and width)	**0**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**2 - FBO, 13 - major tenants / cargo**
Does the Airport have a military presence?	**NO**

Q3

Please upload existing ALP

41-10_01_CVR.pdf (5MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

GRR%20section%202%20question%204.pdf (74.2KB)

Q5

Name of electricity utility provider?

Consumers Energy

Q6

Has an electrical capacity study been undertaken in the last 5 years?

Yes

Q7

If yes, please provide the results.

GRR%20section%203%20question%207.pdf (57KB)

Q8

Number of electrical utility services/feeders into Airport?

There are 3 feeds to the campus, Main Campus Feed with "unlimited" capacity, Kendrick Circuit with 2.8MW of capacity and East Campus feed which is currently in design to be upgraded and modified to loop feed configuration to accommodate new ATCT construction in 2025

Q9

Capacity of each service (if one, what is the capacity of that service)?

our main terminal service feed is based on total 8MW circuit (currently being upgraded as part of new generator back up installation of 5.4 MW / 12,470 volt feed)

Q10

Current availability of power from electrical service?

of the 8MW circuit currently we expect approximately 3.5 MW of load for current projects currently underway. with an added load of 1.25-2.00 MW of need for identified projects currently in design with construction expected in 2024 and 2025. We expect a utility surplus of approximately 3MW at 12,470v

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

We are currently working with Consumers Energy to install 1.75-2.00MW of solar to be installed on our current parking structure. The current design shows this power will be back fed into our 8MW loop once complete.

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

2022 - EV charging station in short term parking
2023 - Backup Generator and Primary redistribution project
2024 - Airport Fleet charging installation
2024 - Long term parking - EV charging stations
2025 - New GSE - storage and maintenance project (rework of old ARFF structure) will include power of electrification of equipment charging stations

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes

Q15 **No**

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Q16 **Yes**

Has the AAM infrastructure needs been evaluated?

Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#7

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Monday, July 03, 2023 6:29:09 AM
Last Modified: Monday, July 03, 2023 11:14:05 AM
Time Spent: 04:44:55
IP Address: 204.12.161.69

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Sandusy City**
FAA ID	**Y83**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**City of Sandusky Michigan**
Airport Contact Person	**Don Johnston**
Preferred Email	**Djohnston@misandusky.com**
Preferred Phone	**810-404-3781**
Airport Address	**1213 N. Sandusky Rd.**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**Current**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**25**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**20%**
Current Number and Size of Cargo Aircraft	**N/A**
Planned Number and Size of Cargo Aircraft	**N/A**
Total Acreage of the Airport	**60**
Any Heliports (list length and width)	**N/A**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**1 FBO and 1 Flight school**
Does the Airport have a military presence?	**No**

Q3

Please upload existing ALP

Respondent skipped this question

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

DTE

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

2

Q9

Capacity of each service (if one, what is the capacity of that service)?

440 three phase

Q10

Current availability of power from electrical service?

Respondent skipped this question

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

Back up Generator to power whole airport

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

possible Tesla power wall for hanger also possible tesla charging station

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

yes

Q15 **Yes**

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Q16 **No**

Has the AAM infrastructure needs been evaluated?

Q17 **Yes**

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Q18 **Yes**

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

#8

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, June 28, 2023 11:57:50 AM
Last Modified: Monday, July 03, 2023 12:20:28 PM
Time Spent: Over a day
IP Address: 47.225.41.22

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Sanderson Field**
FAA ID	**KANJ**
Tier 1 or Tier 2	**2**
Airport Owner	**City of Sault Ste Marie, MI**
Airport Contact Person	**Tom Brown**
Preferred Email	**tbrown@saultcity.com**
Preferred Phone	**906 748 1468**
Airport Address	**2144 Meridian Street**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**small GA**
Is ALP current?	**yes**
Number of enplanements for CY2022	**9067**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**16**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**1%**
Total Acreage of the Airport	**400**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**Great Circle Aviation Services**

Q3

Respondent skipped this question

Please upload existing ALP

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Cloverland Electric Cooperative

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

1

Q9

Capacity of each service (if one, what is the capacity of that service)?

200 amp
440 volt
60 cycle

Q10

Current availability of power from electrical service?

NA

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

NA

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

NA

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Respondent skipped this question

Q15

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

No

Q16

Has the AAM infrastructure needs been evaluated?

No

Q17

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

No

Q18

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

Yes

#9

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Wednesday, July 05, 2023 10:40:41 AM
Last Modified:	Wednesday, July 05, 2023 11:43:38 AM
Time Spent:	01:02:56
IP Address:	161.69.57.47

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Detroit Metro Airport**
FAA ID	**DTW**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**Wayne County Airport Authority**
Airport Contact Person	**John Philbrook**
Preferred Email	**john.philbrook@wcaa.us**
Preferred Phone	**(734) 247-7146**
Airport Address	**11050 Rogell Dr., #602**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Large Hub**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**14,052,931**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**Largest air carrier A-350. 284,606 Operations in 2022.**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**Unknown**
Current Number and Size of Cargo Aircraft	**5,888 Cargo Operations with 873,091,000 lbs landed weight**
Planned Number and Size of Cargo Aircraft	**Unknown**
Total Acreage of the Airport	**4,850**
Any Heliports (list length and width)	**None**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**17 airlines / categories.**
Does the Airport have a military presence?	**Occasional AF-1 and AF-2. No fixed military presence.**

Q3

Please upload existing ALP

Sheet%2004%20-%20DTW%20EXIST%20AIRPORT%20LAYOUT%20PLAN_Nov2021%20Update.pdf (7.2MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Management%20Report%20Year-End%202022.pdf (981.2KB)

Q5

Name of electricity utility provider?

Detroit Edison Company

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

North: 2 @ 40kV South: 2 @ 120kV

Q9

Capacity of each service (if one, what is the capacity of that service)?

North feeders are being decommissioned. Each of the two (2) South feeders is 37.5MVA, offering 100% redundancy.

Q10

Current availability of power from electrical service?

37.5MVA

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

North Campus has one (1) standby generator of 14MW. South Campus has three (3) standby generators of 5.7MW each. Photovoltaic Solar is negligible. No wind, fuel cells or other.

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Currently WCAA has 17 2-port Level 2 Charging stations for public and employees. Future planning in process. Projects in process / planning:
1. Delta Electrical Upgrades for Gates under VALE grant $242,000 est. construction cost. Upgrading GPU / PCA.
2. Delta eGSE Installation of three (3) power stations to the existing MVS400 Charging System, In two different locations A28 /A60 (total of 6 power stations).
3. AVIS is installing 20 Level 2 and one (1) Level 3 chargers.
4. SIGNATURE is installing three (3) Level 2 chargers at B530.
5. HERTZ is installing 12 2-port Level 2 chargers.

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

No

Q15 Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?	**Yes**
Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#10

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, July 06, 2023 10:32:50 AM
Last Modified: Thursday, July 06, 2023 10:44:31 AM
Time Spent: 00:11:41
IP Address: 161.69.57.47

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Willow Run**
FAA ID	**YIP**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**Wayne County Airport Authority**
Airport Contact Person	**John Philbrook**
Preferred Email	**john.philbrook@wcaa.us**
Preferred Phone	**7342477146**
Airport Address	**11050 Rogell Dr., #602**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**Unknown. 86,619 Operations in 2022.**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**Unknown**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**Unknown**
Current Number and Size of Cargo Aircraft	**3,016 Cargo Landings 215,073,000 lbs landed weight**
Planned Number and Size of Cargo Aircraft	**Unknown**
Total Acreage of the Airport	**2,392**
Any Heliports (list length and width)	**None**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**Several FBOs and flight schools**
Does the Airport have a military presence?	**None**

Q3

Please upload existing ALP

Exhibit%20%233%20YIP%20ALP%2003-03-2020.pdf (3.8MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Detroit Edison Company

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

Three (3) feeds

Q9

Capacity of each service (if one, what is the capacity of that service)?

Unknown

Q10

Current availability of power from electrical service?

Unknown.

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

None

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

None

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes

Q15

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Yes

Q16

Has the AAM infrastructure needs been evaluated?

No

Q17

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Yes

Q18

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

Yes

#11

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Thursday, July 06, 2023 11:10:59 AM
Last Modified:	Thursday, July 06, 2023 11:18:09 AM
Time Spent:	00:07:09
IP Address:	68.188.200.121

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**ISQ**
Airport Owner	**Schoolcraft County Airport**
Airport Contact Person	**Steve Videtich**
Preferred Email	**steve_10_49854@yahoo.com**
Preferred Phone	**9063418293**
Airport Address	**5910 US -2**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**small**
Is ALP current?	**yes**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**14**
Total Acreage of the Airport	**240**

Q3

Respondent skipped this question

Please upload existing ALP

Q4

Respondent skipped this question

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Q5

Name of electricity utility provider?

Cloverland Cooperative Electric

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

1

Q9

Capacity of each service (if one, what is the capacity of that service)?

Respondent skipped this question

Q10

Current availability of power from electrical service?

Respondent skipped this question

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

Respondent skipped this question

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Respondent skipped this question

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Respondent skipped this question

Q15 Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?	**No**
Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**No**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#12

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, July 06, 2023 11:20:32 AM
Last Modified: Thursday, July 06, 2023 11:23:04 AM
Time Spent: 00:02:32
IP Address: 198.111.59.162

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Marshall Brooks Field**
FAA ID	**KRMY**
Airport Owner	**City of Marshall**
Airport Contact Person	**Craig Griswold**
Preferred Email	**cgriswold@cityofmarshall.com**
Preferred Phone	**2697814447**
Airport Address	**1243 S Kalamazoo Ave, Marshall, MI 49068**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**

Q3

Please upload existing ALP

Respondent skipped this question

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Respondent skipped this question

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

Respondent skipped this question

Q9

Capacity of each service (if one, what is the capacity of that service)?

Respondent skipped this question

Q10

Current availability of power from electrical service?

Respondent skipped this question

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

Respondent skipped this question

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Respondent skipped this question

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Respondent skipped this question

Q15

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

No

Q16

Has the AAM infrastructure needs been evaluated?

No

Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**No**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**No**

#13

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Thursday, July 06, 2023 11:17:51 AM
Last Modified:	Thursday, July 06, 2023 11:45:10 AM
Time Spent:	00:27:19
IP Address:	97.95.3.160

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Dupont-Lapeer**
FAA ID	**D95**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**Mayfield Township**
Airport Contact Person	**Sandy Swientoniowski**
Preferred Email	**sandy@lapeeraviation.com**
Preferred Phone	**810-664-6966**
Airport Address	**1232 Roods Lake Rd Lapeer, MI 48446**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Small**
Is ALP current?	**Unknown**
Number of enplanements for CY2022	**Unknown**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**60**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**0**
Current Number and Size of Cargo Aircraft	**0**
Planned Number and Size of Cargo Aircraft	**0**
Total Acreage of the Airport	**255**
Any Heliports (list length and width)	**0**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**1**
Does the Airport have a military presence?	**Civil Air**

Q3

Please upload existing ALP

Respondent skipped this question

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

DTE

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

Unknown

Q9

Capacity of each service (if one, what is the capacity of that service)?

Unknown

Q10

Current availability of power from electrical service?

Unknown

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

None

Q12 List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)	**Respondent skipped this question**
Q13 Any existing AAM occurring at the Airport?	**No**
Q14 Is the Airport promoting AAM operations or pursuing AAM related manufacturing?	**Respondent skipped this question**
Q15 Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?	**No**
Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**No**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#14

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Thursday, July 06, 2023 11:54:23 AM
Last Modified:	Thursday, July 06, 2023 12:03:32 PM
Time Spent:	00:09:09
IP Address:	50.200.246.129

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Jackson County Airport-Reynolds Field**
FAA ID	**JXN**
Airport Owner	**Jackson County**
Airport Contact Person	**Juan Zapata**
Preferred Email	**jzapata@mijackson.org**
Preferred Phone	**5177884225**
Airport Address	**3606 Wildwood Ave, Jackson MI 49202**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**yes**
Number of enplanements for CY2022	**0**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**GA - small business jets, light twins and single engine**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**10% annual increase**
Current Number and Size of Cargo Aircraft	**n/a**
Planned Number and Size of Cargo Aircraft	**n/a**
Total Acreage of the Airport	**950**
Any Heliports (list length and width)	**no**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**1**
Does the Airport have a military presence?	**no**

Q3

Please upload existing ALP

38-01%20ALP-01%20Title.pdf (521.6KB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Consumers Energy

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

1

Q9

Capacity of each service (if one, what is the capacity of that service)?

not known

Q10

Current availability of power from electrical service?

Respondent skipped this question

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

none

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

2 level 2 and 3 level 3 (DC) chargers

Q13 **Yes**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes, Zephyr Systems is operating from the airport at this time.
https://zephyrsys.com/

Q15 **Yes**

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Q16 **No**

Has the AAM infrastructure needs been evaluated?

Q17 **Yes**

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Q18 **Yes**

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

#15

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Thursday, July 06, 2023 12:52:43 PM
Last Modified:	Thursday, July 06, 2023 1:13:43 PM
Time Spent:	00:20:59
IP Address:	173.10.34.181

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Capital Region International Airport**
FAA ID	**LAN**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**Capital Region Airport Authority**
Airport Contact Person	**Robert Benstein**
Preferred Email	**rbenstein@craa.com**
Preferred Phone	**517-886-3716**
Airport Address	**4100 Capital City Blvd., Lansing, MI 48906**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Non-Hub Commercial Service**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**90,922**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**65 based aircraft/28,464 operations**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**5% increase in operations by CY2024**
Current Number and Size of Cargo Aircraft	**Annual landings: MD-11 - 260, A300 - 212, B757 - 29, EMB-120 - 520, B1900 - 1,300, SW4 - 260, and C-208 - 1,040**
Planned Number and Size of Cargo Aircraft	**No Change**
Total Acreage of the Airport	**2,083**
Any Heliports (list length and width)	**N/A**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**FBO - Avflight, major tenant - UPS**
Does the Airport have a military presence?	**Yes, MI Army National Guard - 1 based C-12 (King Air)**

Q3

Please upload existing ALP

LAN%20ALP%20pages%201-5.pdf (10MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Consumers Energy (north) and Lansing Board of Water and Light (south)

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

Respondent skipped this question

If yes, please provide the results.

Q8

Number of electrical utility services/feeders into Airport?

2

Q9

Capacity of each service (if one, what is the capacity of that service)?

Willow sub-station; Circuit 958 - 12,200 volts, 350 amps; Circuit 963 - 12,200 volts, 350 amps

Q10

Current availability of power from electrical service?

Circuit 958 load - 158 amps; Circuit 963 load - 202 amps

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

N/A

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Install four (4) Level II chargers in short-term parking lot

Q13

No

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Currently updating Master Plan, which will address AAM operations and manufacturing

Q15 Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?	**Yes**
Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#16

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, July 06, 2023 1:50:22 PM
Last Modified: Thursday, July 06, 2023 2:04:40 PM
Time Spent: 00:14:17
IP Address: 12.43.11.192

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Oakland County International Airport**
FAA ID	**PTK**
Tier 1 or Tier 2	**Tier 2**
Airport Owner	**County of Oakland**
Airport Contact Person	**Cheryl Bush**
Preferred Email	**bushc@oakgov.com**
Preferred Phone	**(248) 666-5680**
Airport Address	**6500 Patterson Parkway, Waterford**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**ALP has been updated**
Number of enplanements for CY2022	**142,535**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**GA-129,000 Air Taxi-13,000 Carrier-400 Military-400; 615 based aircraft**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**5% growth y/y for next 5 yrs**
Current Number and Size of Cargo Aircraft	**Up to DC-9 and Boeing 747**
Planned Number and Size of Cargo Aircraft	**N/A**
Total Acreage of the Airport	**751 acres**
Any Heliports (list length and width)	**no**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**7 FBO's including 2 cargo operators; 4 flight schools**
Does the Airport have a military presence?	**Occasional VIP visits and Selfridge Ops**

Q3

Please upload existing ALP

Respondent skipped this question

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

DTE

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

Unknown

Q9

Capacity of each service (if one, what is the capacity of that service)?

Unknown

Q10

Current availability of power from electrical service?

Adequate

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

Wind spires at terminal - currently inop

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

airport vehicles and equipment

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes, currently working with FEV in Auburn Hills

Q15 **Yes**

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Q16 **No**

Has the AAM infrastructure needs been evaluated?

Q17 **Yes**

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Q18 **Yes**

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

#17

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, July 07, 2023 6:11:11 AM
Last Modified: Friday, July 07, 2023 6:38:59 AM
Time Spent: 00:27:48
IP Address: 71.13.103.154

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Dickinson County Ford Airport**
FAA ID	**Kimt**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**Dickinson County**
Airport Contact Person	**Tim Howen**
Preferred Email	**thowen58@hotmail.com**
Preferred Phone	**906-201-1866**
Airport Address	**500 Riverhills Road Kingsford Mi 49802**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**small**
Is ALP current?	**yes**
Number of enplanements for CY2022	**20,647**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**44**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**10% increase by May of 2024**
Current Number and Size of Cargo Aircraft	**6 Cessna Caravans 1 Beech 1900**
Planned Number and Size of Cargo Aircraft	**Adding one more Cessna 406**
Total Acreage of the Airport	**780**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**Two FBO's Kubick Aviation and Classic Aero Maintenance. Main Headquarters for CSA Air (FedEx) Maintenance/Operations/ Training. I (Tim Howen) teach an Aviation Highschool program here at the Airport. We have built turbine engines, Drones, Experimental Aircraft, at the end of the month we are taking delivery of our new turbine helicopter kit from Composite FX out of Florida. The Company has been testing electric versions of their helicopter with very good success. Last month we partnered up with the EAA museum in Oshkosh Wi. to start a museum here at our facility, we took delivery of our first plane that day.**
Does the Airport have a military presence?	**Not full time only for training missions, US Wildlife Services has a crew based here for the summer for helicopter fire fighting.**

Q3

Respondent skipped this question

Please upload existing ALP

Q4

Respondent skipped this question

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Q5

Name of electricity utility provider?

We Energies

Q6

Has an electrical capacity study been undertaken in the last 5 years?

Yes

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

one

Q9

Capacity of each service (if one, what is the capacity of that service)?

N/A

Q10

Current availability of power from electrical service?

N/A

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

None

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

We are building a new terminal, currently we are in the design/ Engineering phase the need for electric charging stations is a must in our new build.

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes, Through our school program

Q15

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Yes

Q16

Has the AAM infrastructure needs been evaluated?

No

Q17

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Yes

Q18

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

Yes

#18

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, July 07, 2023 7:39:56 AM
Last Modified: Friday, July 07, 2023 7:42:44 AM
Time Spent: 00:02:47
IP Address: 198.109.195.2

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Hillsdale Municipal Airport**
FAA ID	**JYM**
Airport Owner	**city of Hillsdale**
Airport Contact Person	**Ginger Moore**
Preferred Email	**Hillsdale_Airport@cityofhillsdale.org**
Preferred Phone	**5177974833**
Airport Address	**1727 Airport Rd.**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**Yes**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**19**
Total Acreage of the Airport	**528**

Q3

Respondent skipped this question

Please upload existing ALP

Q4

Respondent skipped this question

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Q5

Name of electricity utility provider?

BPU

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

Respondent skipped this question

Q9

Capacity of each service (if one, what is the capacity of that service)?

Respondent skipped this question

Q10

Current availability of power from electrical service?

Respondent skipped this question

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

Respondent skipped this question

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Respondent skipped this question

Q13

Any existing AAM occurring at the Airport?

Respondent skipped this question

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Respondent skipped this question

Q15 Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?	**No**
Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#19

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Friday, July 07, 2023 11:22:08 AM
Last Modified:	Friday, July 07, 2023 12:05:13 PM
Time Spent:	00:43:04
IP Address:	198.108.51.186

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Ann Arbor Municipal**
FAA ID	**ARB**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**City of Ann Arbor**
Airport Contact Person	**Matthew J Kulhanek**
Preferred Email	**mjkulhanek@a2gov.org**
Preferred Phone	**734.794.6312**
Airport Address	**801 Airport Drive, Ann Arbor, MI 48108**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**unknown - not a commercial service airport**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**84,803 ops for CY22, 170 based aircraft, see attachment A**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**see attachment A, though we have already exceeded 2039 operations projections**
Current Number and Size of Cargo Aircraft	**0**
Planned Number and Size of Cargo Aircraft	**0**
Total Acreage of the Airport	**729**
Any Heliports (list length and width)	**no**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**3 FBO - Solo Aviation, ACE Aviation Center, Bijan Air (helicopter only), U of M Flyers & AA Flyers Flying Clubs, EAA #333, Civil Air Patrol, AvFuel HQ**
Does the Airport have a military presence?	**no (only Civil Air Patrol)**

Q3

Please upload existing ALP

2008%20PROPOSED%20ALP%20HALF.pdf (4.8MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

ARB%20Attachment%20A%200723.pdf (219.7KB)

Q5

Name of electricity utility provider?

DTE

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

10

Q9

Capacity of each service (if one, what is the capacity of that service)?

information pending

Q10

Current availability of power from electrical service?

information pending

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

Currently working on 4 separate PV solar installs at the airport. Site 1 = 32 KwDC, site 2 = 78 KwDC, site 3 = 71 KwDC, site 4 = 605 KwDC.

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

tbd

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

ARB is open to AAM operations, but no active promotions at this time.

Q15 **No**

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

#20

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Thursday, July 20, 2023 6:10:56 AM
Last Modified:	Thursday, July 20, 2023 6:17:39 AM
Time Spent:	00:06:43
IP Address:	96.36.25.26

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Chippewa County International Airport**
FAA ID	**3-26-0139**
Airport Owner	**Chippewa County**
Airport Contact Person	**Tami L. Beseau**
Preferred Email	**chippewacountyairport@outlook.com**
Preferred Phone	**906 495-5631 Ext. #4**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Non Hub**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**22,000**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**CRJ 200, CRJ 700, CRJ 900 18 based aircraft**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**Larger aircraft CRJ 700 or 900 in 2023**
Current Number and Size of Cargo Aircraft	**Metro liner, Beechcraft 1900 and Caravan**
Planned Number and Size of Cargo Aircraft	**same**
Total Acreage of the Airport	**800+**
Any Heliports (list length and width)	**no**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**EDC of Chippewa County FBO 906 495-3835**
Does the Airport have a military presence?	**no**

Q3

Please upload existing ALP

Respondent skipped this question

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Cloverland Electric

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

Cloverland Electric

Q9

Capacity of each service (if one, what is the capacity of that service)?

Respondent skipped this question

Q10

Current availability of power from electrical service?

Respondent skipped this question

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

none

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

none

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

not at this time

Q15

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

No

Q16

Has the AAM infrastructure needs been evaluated?

No

Q17

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Yes

Q18

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

No

#21

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Monday, July 24, 2023 7:31:51 AM
Last Modified:	Monday, July 24, 2023 8:17:09 AM
Time Spent:	00:45:17
IP Address:	64.20.198.104

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Kalamazoo/Battle Creek International Airport**
FAA ID	**AZO**
Airport Owner	**Kalamazoo County**
Airport Contact Person	**Anton Bjorkman**
Preferred Email	**eabjor@kalcounty.com**
Preferred Phone	**269-366-3002**
Airport Address	**5235 Portage Road, Kalamazoo, MI 49002**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Non-Hub**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**72,551**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**CRJ 200, 700, 900 / B 737-800**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**15% by end of CY 2023**
Current Number and Size of Cargo Aircraft	**0**
Planned Number and Size of Cargo Aircraft	**0**
Total Acreage of the Airport	**Apprx. 680**
Any Heliports (list length and width)	**No**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**Duncan Aviation**
Does the Airport have a military presence?	**No**

Q3

Please upload existing ALP

39-02%20ALP-03%20Ex%20ALP.pdf (3.4MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Consumers Energy

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

1

Q9

Capacity of each service (if one, what is the capacity of that service)?

Unknown

Q10

Current availability of power from electrical service?

Unknown

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

N/A

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

N/A

Q13

Any existing AAM occurring at the Airport?

No

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

No

Q15

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

No

Q16

Has the AAM infrastructure needs been evaluated?

No

Q17

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

No

Q18

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

Yes

#22

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, August 09, 2023 5:38:37 AM
Last Modified: Wednesday, August 09, 2023 5:45:32 AM
Time Spent: 00:06:55
IP Address: 152.160.164.130

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Aaron Thelenwood**
FAA ID	**BIV**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**West Michigan Regional Airport Authority**
Airport Contact Person	**Aaron Thelenwood**
Preferred Email	**a.thelenwood@wmraa.org**
Preferred Phone	**6163683023**
Airport Address	**60 Geurink Blvd.**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**Yes**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**54 based aircraft, 12 jets, 34,000 total operations annually,**
Current Number and Size of Cargo Aircraft	**N/A all cargo is transient**
Total Acreage of the Airport	**507**
Any Heliports (list length and width)	**N/A**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**FBO: 1, Flight School: 1, Aircraft MRO: 1, Corporate Hangars: 3; Aircraft Component Manufacturer: 2**
Does the Airport have a military presence?	**Not based, but frequently used by Coast Guard**

Q3

Please upload existing ALP

4%20-%20BIV%20ALP%20Future%20ALP.pdf (2.7MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Respondent skipped this question

Q5

Name of electricity utility provider?

Holland Board of Public Works

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

Unsure

Q9

Capacity of each service (if one, what is the capacity of that service)?

Unsure

Q10

Current availability of power from electrical service?

Available

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

N/A though exploring options

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Heavily involved in conversations with AAM Manufacturers and support infrastructure (Including EVA Labs, and Volatus) partnering on feasibility study with Metro Consulting Associates, potential collaborator with Battle Creek unlimited and their drone corridor initiatives, lookingfor partnership opportunities with Snowbotix, DANNAR, Renu-robotix on electric utility vehicles and services, current memebr of the FLITE project review committee at GRR.

Q13 **Yes**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes, actively and heavily, see 12 for reference. Additionally, partnering with Ottawa Area ISD on FAA workforce development grants that will focus on AAM workforce development for both pilot and mechanic career tracks.

Q15 **Yes**

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Q16 **No**

Has the AAM infrastructure needs been evaluated?

Q17 **Yes**

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Q18 **Yes**

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

#23

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, August 11, 2023 6:31:40 AM
Last Modified: Friday, August 11, 2023 7:09:47 AM
Time Spent: 00:38:07
IP Address: 64.20.195.47

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Battle Creek Executive Airport at Kellogg Field**
FAA ID	**KBTL**
Tier 1 or Tier 2	**Tier 1**
Airport Owner	**City of Battle Creek**
Airport Contact Person	**Phil Kroll**
Preferred Email	**PSKroll@battlcreekmi.gov**
Preferred Phone	**269-966-3470**
Airport Address	**15551 S. Airport Rd. Battle Creek, MI 49015**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**GA**
Is ALP current?	**Yes, ALP update underway**
Number of enplanements for CY2022	**0**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**based AC: 93. 2022 ops: 97,206**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**3% increase yoy**
Current Number and Size of Cargo Aircraft	**Cargo tons delivered: 4,613**
Planned Number and Size of Cargo Aircraft	**unk**
Total Acreage of the Airport	**1,400**
Any Heliports (list length and width)	**0**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**2**
Does the Airport have a military presence?	**Yes**

Q3

Please upload existing ALP

13-01%20ALP-03%20Ex%20ALP.pdf (2.4MB)

Q4

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

BTL%202022%20ops.pdf (40.4KB)

Q5

Name of electricity utility provider?

Consumers Energy

Q6

Has an electrical capacity study been undertaken in the last 5 years?

No

Q7

If yes, please provide the results.

Respondent skipped this question

Q8

Number of electrical utility services/feeders into Airport?

Respondent skipped this question

Q9

Capacity of each service (if one, what is the capacity of that service)?

Respondent skipped this question

Q10

Current availability of power from electrical service?

Respondent skipped this question

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

Currently in planning stage. Possibly 100 acres of solar at various locations around the airport

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Planning stage. Providing charging stations for GSE, employee parking, and future mobility.

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes, military and civilian

Q15 **Yes**

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Q16 **Yes**

Has the AAM infrastructure needs been evaluated?

Q17 **Yes**

Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?

Q18 **Yes**

Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?

#24

COMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Friday, August 11, 2023 8:04:31 AM
Last Modified:	Friday, August 11, 2023 10:08:04 AM
Time Spent:	02:03:33
IP Address:	64.85.164.131

Page 1: Initial Airport Survey

Q1

Airport Contact Information:

Name of Airport	**Muskegon County Airport**
FAA ID	**MKG**
Tier 1 or Tier 2	**Primary Non-Hub. I'm not familiar with the "Tier" categorization.**
Airport Owner	**Muskegon County**
Airport Contact Person	**Ken Efting**
Preferred Email	**kefting@f3airport.com**
Preferred Phone	**231-798-4596, ext 4903**
Airport Address	**99 Sinclair Dr. Muskegon MI, 49441**

Q2

Airport Characteristics:

Airport Type (Large, Medium, Small, Non-Hub, GA)	**Non-Hub**
Is ALP current?	**Yes**
Number of enplanements for CY2022	**10,791**
Current Aircraft Fleet Mix, based aircraft and/or Number of Operations by Aircraft	**91 based aircraft, 18,363 operations in FY22.**
Planned % Increase/Decrease in Aircraft or Operations (specify time period)	**25% increase in based aircraft over next 5 years.**
Current Number and Size of Cargo Aircraft	**None based, but have one daily cargo operation from MartinAiree**
Total Acreage of the Airport	**~1100**
Any Heliports (list length and width)	**1 marked. 75'x75'**
Number and listing of Fixed Based Operators (FBOs) or major tenants (cargo, manufacturing, flight schools, etc.)	**1 FBO - Executive Air Transport**
Does the Airport have a military presence?	**Yes, a seasonal USCG station that operates from Memorial Day to Labor Day.**

Q3

Please upload existing ALP

2017_03_ALP_Base%20%202017_03_28.pdf (1.5MB)

Q4

Respondent skipped this question

Aircraft Fleet Mix / Number of Ops (if needed attachment space)

Q5

Name of electricity utility provider?

Consumers Energy

Q6

No

Has an electrical capacity study been undertaken in the last 5 years?

Q7

Respondent skipped this question

If yes, please provide the results.

Q8

Number of electrical utility services/feeders into Airport?

1

Q9

Capacity of each service (if one, what is the capacity of that service)?

UNK

Q10

Current availability of power from electrical service?

Excellent

Q11

Description of any sustainable power produced on-site at the Airport? (Photovoltaics, Wind, Fuel cells, other), including system size and location

None

Q12

List of existing and planned electrification projects for vehicles/equipment? (Aircraft, Ground Support Equipment [GSE], Employee/Passenger parking, shuttle buses, etc.)

Procure two ZEV for airport operations.

Q13 **No**

Any existing AAM occurring at the Airport?

Q14

Is the Airport promoting AAM operations or pursuing AAM related manufacturing?

Yes

Q15 **Yes**

Has the Airport been approached by any companies interested in operatating electrical aircraft (including uncrewed aerial systems [UAS] or advanced air mobility systems [AAM]) at the Airport?

Q16 Has the AAM infrastructure needs been evaluated?	**No**
Q17 Are you aware of MDOT's plans to pilot Multimodal Airport Charging Systems in Michigan?	**Yes**
Q18 Would your airport be interested in learning more about getting involved in this study, including how you could benefit from a multimodal charging system?	**Yes**

Appendix C:
Airport Shortlist Selection Narrative

C&S Engineers, Inc.
38777 Six Mile Rd. Suite 202
Livonia, MI 48152

Michigan Department of Transportation Multimodal Aircraft Charging Station Deployment—Phase 1

Airport Short-List Selection Narrative

October 2023

MDOT
Michigan Department of Transportation

Introduction

The C&S team (C&S Engineers and HoveCon) conducted a comprehensive process to assess and rank airports within the State of Michigan with publicly available data as well as responses from individual airports to a survey of their current infrastructure and desire to host a multi-modal charging system. This multi-step process involved the evaluation of various relevant variables to determine which airports are best positioned to excel in the emerging markets of advanced air mobility (AAM) and regional air mobility (RAM) for integrating electrification in transportation and aviation, encompassing both cargo and passenger movement. AAM is a vision of a safe, accessible, automated, and affordable air transportation system for passengers and cargo using electrical vertical take-off and landing aircraft (eVTOL). RAM focuses on building upon existing airport infrastructure to transport people and goods using innovative aircraft that offer improvement in efficiency, affordability, and community-friendly integration over existing regional transportation options. These aircraft include electric and hybrid electric powered planes. The ultimate goal was to identify a short list of five to six airports based on their ranking for each identified variable and categorize them based on the ten prosperity regions. A secondary goal was to provide a matrix that MDOT could use in the future for similar initiatives.

A summary of the methodology and the recommended short-list of airports is provided below:

Methodology

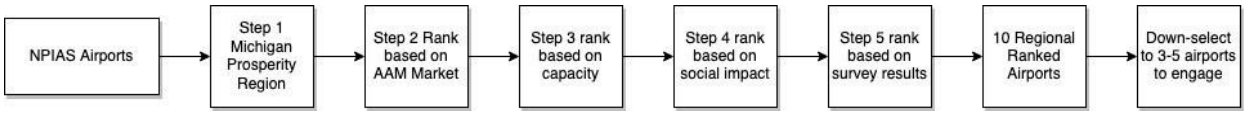
The C&S Team identified 95 National Plan of Integrated Airport Systems (NPIAS) candidate public use and/or public owned airports in Michigan. Each of these airports were evaluated based on a number of variables using available information. A detailed overview of each variable, source and the selection criteria applied is provided in the attached Excel matrix spreadsheet and will be detailed in the final report.

First, the C&S team undertook the task of selecting key variables critical to gauge each airport's readiness for multimodal electrification. These variables were chosen to encompass a wide range of factors, including, but not limited to, available infrastructure at airports to support eVTOL transient aircraft, based aircraft, accessibility to the population center, and demographic data, ensuring a comprehensive assessment.

Based on the initial assessment, a total of ten variables were identified to be used in developing an airport selection decision tree. In addition, the C&S team also included the 25 responses from the survey sent to airports that inquired about the airport’s readiness for eVTOLs and willingness to participate in the evaluation process.

After identifying the variables and aggregating the data, the C&S team applied the selected variables to each of the 95 airports. These variables were weighted based on their significance in the AAM and RAM

markets. Each airport was ranked individually, with higher scores indicating a stronger potential to excel in these markets. Every airport's ranking also considered region-specific, economic, and demographic factors. This approach accounted for regional disparities and opportunities, enhancing the representativeness of our assessment regarding each airport's potential in the AAM and RAM markets. The figure below shows the steps that were used in the evaluation process.



The C&S team computed an aggregate ranking for each airport by incorporating their location based on the MI prosperity region. This aggregate ranking offered a holistic view of how each airport fares relative to others across Michigan. The top ranked airport in each prosperity region is listed in **Table 1**.

Table 1. Top Ranked Airport by Prosperity Region

	Airport Code	Prosperity Regions #	Final Score
Ford Airport	IMT	1	5
Cherry Capital Airport	TVC	2	9
Gaylord Regional Airport	GLR	3	4
Gerald R. Ford International Airport	GRR	4	10
James Clements Municipal Airport	3CM	5	5
Bishop International Airport	FNT	6	8
Capital Region International Airport	LAN	7	10
Battle Creek Executive Airport at Kellogg Field	BTL	8	12
Ann Arbor Municipal Airport	ARB	9	10
Willow Run Airport	YIP	10	9

Based on the evaluation process, the C&S team recommends the six airports listed in **Table 2** as the short-list of airports for further evaluation, including interviews with airport management and a site visit.

Table 2. Recommended Airports for Further Evaluation

Airport	Airport Code	MI Prosperity Region	Airport Type
Cherry Capital Airport	TVC	2	Primary – Non-Hub
Gerald R. Ford International Airport	GRR	4	Primary – Small-Hub
Capital Region International Airport	LAN	7	Primary – Non-Hub
Battle Creek Executive Airport at Kellogg Field	BTL	8	General Aviation
Ann Arbor Municipal Airport	ARB	9	General Aviation
Willow Run Airport	YIP	10	General Aviation

Conclusion

Based on a comprehensive assessment process identified in the C&S Memo dated July 27, 2023, the C&S team considered a number of variables and regional factors from public sources as well as input from the survey of interested airports to identify a short-list of six candidate airports for further evaluation. As shown in **Table 2**, the short-list contains three primary airports (one small hub and two non-hub) and three general aviation (GA) airports, which represent 6 of the 10 Michigan Prosperity Regions. These airports show initial promise in supporting a multi-modal charging station and the emerging markets of AAM and RAM.

Attachment A provides a summary of the ranking of the 95 airports evaluated by prosperity region, while **Attachment B** illustrates the location of the six short-list airports.

Attachment A
Final Airport Ranking

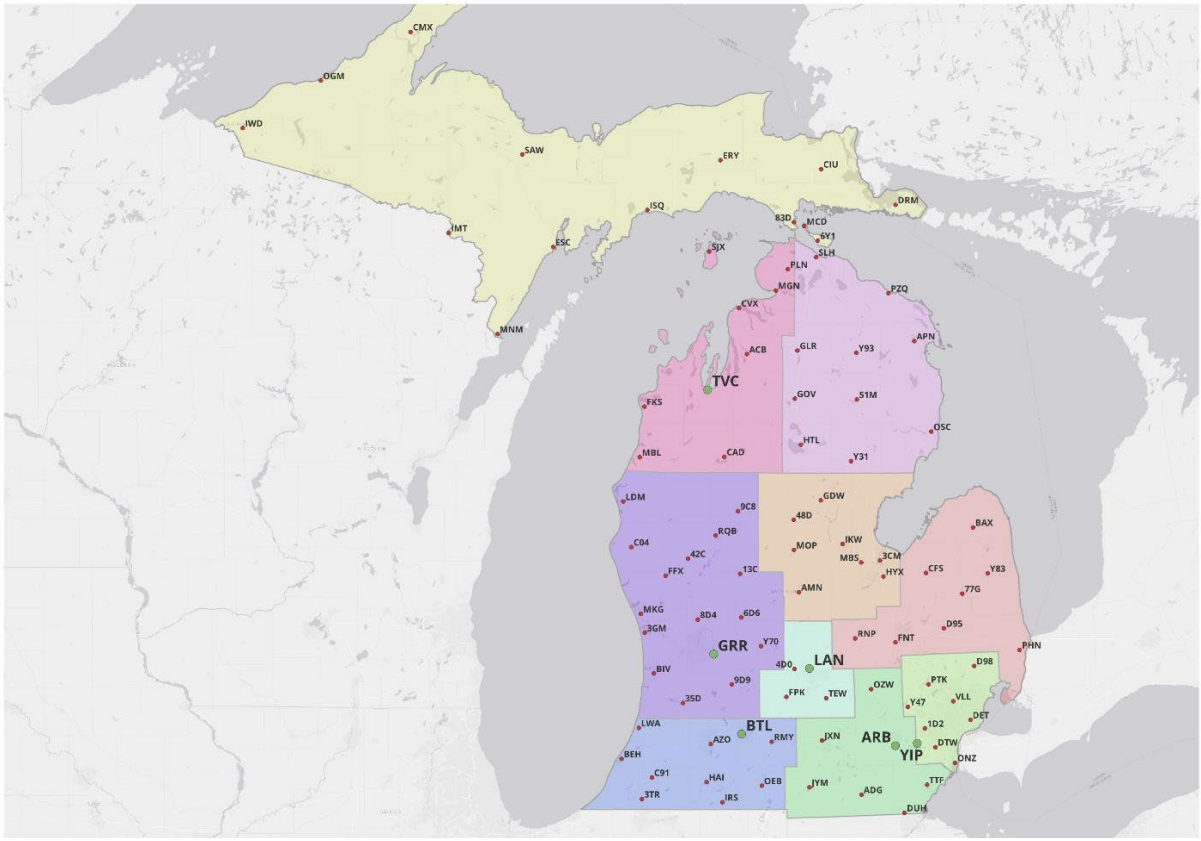
	Prosperity Region #	AAM Market	Capacity	Social Impact	Survey Interest	Final Score
IMT	1	2	0	2	1	**5**
SAW	1	0	3	1	0	**4**
6Y1	1	0	2	1	0	**3**
CIU	1	0	2	1	0	**3**
83D	1	0	2	1	0	**3**
ISQ	1	0	1	1	1	**3**
CMX	1	0	1	1	0	**2**
ERY	1	0	1	1	0	**2**
DRM	1	0	1	1	0	**2**
IWD	1	0	1	1	0	**2**
MNM	1	0	1	1	0	**2**
ESC	1	0	0	1	0	**1**
MCD	1	0	0	1	0	**1**
OGM	1	0	0	0	0	**0**
TVC	2	3	2	3	1	**9**
CAD	2	0	3	1	0	**4**
CVX	2	0	2	2	0	**4**
MBL	2	0	2	2	0	**4**
ACB	2	0	3	0	0	**3**
FKS	2	0	2	1	0	**3**
MGN	2	0	2	1	0	**3**
PLN	2	0	1	1	0	**2**
SJX	2	0	0	1	0	**1**
GLR	3	0	2	2	0	**4**
GOV	3	0	3	1	0	**4**
HTL	3	0	3	1	0	**4**
APN	3	0	2	1	0	**3**
51M	3	0	2	0	0	**2**
OSC	3	0	1	1	0	**2**

	Prosperity Region #	AAM Market	Capacity	Social Impact	Survey Interest	Final Score
SLH	3	0	0	1	0	**1**
Y31	3	0	0	1	0	**1**
PZQ	3	0	0	1	0	**1**
Y93	3	0	1	0	0	**1**
GRR	4	2	2	5	1	**10**
BIV	4	2	3	2	1	**8**
3GM	4	1	3	2	1	**7**
MKG	4	2	1	1	1	**5**
35D	4	0	3	1	0	**4**
8D4	4	0	2	2	0	**4**
9D9	4	0	3	1	0	**4**
13C	4	0	2	1	0	**3**
42C	4	0	1	2	0	**3**
6D6	4	0	2	1	0	**3**
9C8	4	0	2	0	0	**2**
C04	4	0	0	2	0	**2**
FFX	4	0	1	1	0	**2**
LDM	4	0	1	1	0	**2**
Y70	4	0	0	2	0	**2**
RQB	4	0	0	0	0	**0**
3CM	5	0	3	1	1	**5**
HYX	5	0	2	2	0	**4**
IKW	5	0	1	3	0	**4**
48D	5	0	4	0	0	**4**
MBS	5	0	1	2	1	**4**
GDW	5	0	2	1	0	**3**
MOP	5	1	1	0	1	**3**
AMN	5	0	2	0	0	**2**
FNT	6	0	4	4	0	**8**
Y83	6	2	0	2	1	**5**
77G	6	0	3	1	0	**4**

	Prosperity Region #	AAM Market	Capacity	Social Impact	Survey Interest	Final Score
D95	6	0	1	2	1	**4**
BAX	6	0	3	1	0	**4**
PHN	6	0	1	2	0	**3**
RNP	6	0	0	2	0	**2**
CFS	6	0	1	1	0	**2**
LAN	7	2	3	4	1	**10**
4D0	7	0	2	2	0	**4**
TEW	7	0	1	2	0	**3**
FPK	7	0	1	2	0	**3**
BTL	8	3	2	6	1	**12**
AZO	8	0	5	4	1	**10**
RMY	8	0	3	2	1	**6**
BEH	8	0	1	3	0	**4**
HAI	8	0	3	1	0	**4**
LWA	8	0	2	2	0	**4**
3TR	8	0	2	1	0	**3**
C91	8	0	1	1	0	**2**
IRS	8	0	0	1	0	**1**
OEB	8	0	0	1	0	**1**
ARB	9	2	2	5	1	**10**
JXN	9	3	2	2	1	**8**
OZW	9	0	1	2	1	**4**
TTF	9	0	2	2	0	**4**
ADG	9	0	2	1	0	**3**
DUH	9	0	1	2	0	**3**
JYM	9	0	1	0	1	**2**
YIP	10	2	2	4	1	**9**
PTK	10	2	3	2	1	**8**
VLL	10	0	3	4	0	**7**
DTW	10	1	1	4	1	**7**

	Prosperity Region #	AAM Market	Capacity	Social Impact	Survey Interest	Final Score
DET	10	0	2	4	0	**6**
ONZ	10	0	2	4	0	**6**
Y47	10	0	1	4	0	**5**
1D2	10	0	3	1	0	**4**
D98	10	0	2	2	0	**4**

Attachment B
Map with Recommended Airports



Appendix D:
Site Visit Checklist

Multimodal Charging Station Site-Visit Checklist

November 2023

Airport Name: Ann Arbor Municipal Airport

Airport Identifier: ARB

Airport Location: Ann Arbor, MI

Site-Visit Date: 11/17/2023

Questions		Notes
Primary contact for airport?		**Matt Kulhanek**
Engineering contact for airport?		**No electrical engineer for the city. C&S can be the contact.**
Who is the utility provider? Point of contact?		DTE – they have about 10 different connections around the airport all with different accounts. Terminal has all airfield lighting. Got list of service locations from Matt.
Do you have your own utility loop? (A substation on site and everything you manage thereafter)	**Y / N**	**NO**
Known current electrical capacity?		Get this from airport electrician
Do you currently have EV charging stations?	**Y / N**	**None, they have been talking about this for the airport. They have 50 for the city of Ann Arbor for their fleet. City has 4 refuse trucks coming. 4 fast chargers at city hall.**
Have you looked into funding for EV chargers? (What have collaborations with charging providers looked like?)	**Y / N**	**Yes DTE has charging forward program – level 2 ($2500 per port from DTE) Larger amounts for fast chargers (up to $70,000) Other state funding, BIL funding**

Questions		Notes
What do you expect for EV traffic?		If they put in fast chargers at the airport they could pull people off the freeway. Reliability of chargers is not good in general, Ann Arbor has good ones. Ability to put comments in from the public at the chargers. City chargers are reliable. Parking lot is full a lot, they need more parking. Ann Arbor is poised for both landside and airside. Sustainability is a big deal here. He could see a shuttle from here (maybe downtown rather than airport?) to DTW. Possible for medical purposes Could see single engine electric aircraft being used here
Are there any hotspots on the airfield?	**Y / N**	**Crossing of turf runway at Taxiway A and Taxiway A at the east end where the tower doesn't have line of site**
Are there any possible obstructions to approach surfaces?	**Y / N**	**None**
Is airport property constrained by a natural or physical barrier? (i.e., water ways, wildlife habitats)	**Y / N**	**Roads on the north and east** **Woods on the south** **Ditch on the west**
Are there space/expansion constraints (i.e., open space for solar fields)?	**Y / N**	**4 locations where solar is going in at the airport (Matt will give us the plans)** **Climate action millage passed in the city, and ARPA funds for solar at city facilities will pay for this**
Are there other plans for this space?	**Y / N**	**Not in the space near the terminal** **Space on the east has been discussed to add corporate hangars**
Do you have an ARFF? (Who responds to a fire?)	**Y / N**	**Pittsfield Twp – fire station is right next to the airport. Non-Part 139 so no ARFF required**

Questions		Notes
Are you handling cargo? (How/where is it located?)	Y / N	**NO**
Can we request a new facility service?	Y / N	**Yes – they have several now**
Is public transportation available to the airport?	Y / N	**Bus stop is available on Airport Blvd. north of Ellsworth**
Is maintenance information kept in a software/database system?	Y / N	**NO**
Do airport staff/airport sponsor have knowledge on Advanced Air Mobility (AAM)? (Is there interest for a vertiport at the airport?)	Y / N	**Yes**
Would staff be available to oversee vertiport activities? (How many full-time airport staff are there?)	Y / N	**No they do not have the staff to oversee it.** **Matt – 3 maintenance staff, billing done by city person downtown.** **FBO would have to do this.**

Data	Photos (X if applicable)	Notes
Airport Layout Plan		Complete, in F-Drive
Existing conditions, grading, natural elements	X	
Master plans for future expansion		
Utility locations	X	
Nearby equipment	X	
One-line diagrams and panel schedules		
Utility loop drawings (if applicable)		
Staff Org chart		See notes above
Transformer / Overhead poles	X	

Notes for C&S Team

- Bring multi-modal concept drawing for airport consideration
- Bring map to mark and understand feasibility of locations
- If applicable, drive around to assess feasible locations

Comments

Wheeler service center – charge point express plus installed, can add power modules (can do up to 350 kW) and connect 4 chargers to it. One central power block, not mobile. New express plus can do up to 500kW.
4 national connections (j1772 is one)
Money will be spent per year for cloud plan just having chargers on site - $1200/year – Would this be included in MDOT's project
No manufacturers have a plow for electric trucks

Location of charger – will likely want to be near the terminal at terminal ramp

DTE ran a new service for the city for fast chargers and paid for the service, 24 chargers. Part of a pilot program and they are not doing this anymore.

Multimodal Charging Station Site-Visit Checklist

November 2023

Airport Name: Battle Creek Executive Airport

Airport Identifier: BTL

Airport Location: Battle Creek, Michigan

Site-Visit Date: 11/14/2023

Questions		Notes
Primary contact for airport?		**Phil Kroll**
Engineering contact for airport?		**Jarret Geering** **jtgeering@battlecreekmi.gov** **(269) 966-3355 ext. 1863**
Who is the utility provider? Point of contact?		**Consumers Energy- Contact Jarret**
Do you have your own utility loop? (A substation on site and everything you manage thereafter)	**Y / N**	-
Known current electrical capacity?		Unknown – Jarret may know
Do you currently have EV charging stations?	**Y / N**	**Stations are non-airport, FBO and tenant owned, but there are spaces to park. Duncan has remote control TBTV, Western has a charger for their small bus.**
Have you looked into funding for EV chargers? (What have collaborations with charging providers looked like?)	**Y / N**	**Minimal discussions, collaboration would come from University's College of Engineering. Started conversation with BCU but not too far involved. University is partnering with the airport on writing a grant for electrification.**
What do you expect for EV traffic?		**Hopeful, Tenant GSE, Planning for increased EV aircraft and new fleet vehicles such as golf carts or gators.**
Are there any hotspots on the airfield?	**Y / N**	-
Are there any possible obstructions to approach surfaces?	**Y / N**	**Obstructions are currently being worked on. Identified obstructions and plans in place.**

Questions		Notes
Is airport property constrained by a natural or physical barrier? (i.e., water ways, wildlife habitats)	Y / N	Wetlands, RR on West side, Residential on East side, Industrial buildings on South side, Guard base North.
Are there space/expansion constraints (i.e., open space for solar fields)?	N/A	Nothing planned for certain, they've had some inquiries.
Are there other plans for this space?	Y / N	Possible aeronautical or non-aeronautical use.
Do you have an ARFF? (Who responds to a fire?)	Y / N	2 ARFF vehicles (Stryker 1500), vehicles on site, but no longer Part 139 airport so the city responds
Are you handling cargo? (How/where is it located?)	Y / N	Duncan (FBO) handles cargo, 4600 tons (# to be given in follow up).
Can we request a new facility service?	Y / N	Ask Consumers or Jarret.
Is public transportation available to the airport?	Y / N	Bus service is available (On demand through BCU), BC go, Western runs a shuttle to campus.
Is maintenance information kept in a software/database system?	Y / N	-
Do airport staff/airport sponsor have knowledge on Advanced Air Mobility (AAM)? (Is there interest for a vertiport at the airport?)	Y / N	Yes, interest.
Would staff be available to oversee vertiport activities? (How many full-time airport staff are there?)	Y / N	11 full time airport staff, 2 FBOs currently (Centennial and Duncan, Waco bought Centennial), FBO on-call services, and additional airport staff.

Data	Photos (X if applicable)	Notes
Airport Layout Plan		Complete, in F-Drive, update coming (approved from 2002)
Existing conditions, grading, natural elements	X	
Master plans for future expansion		Follow-up, West Side master plan- he will send
Utility locations	X	
Nearby equipment	X	
One-line diagrams and panel schedules		Follow-up from electrician
Utility loop drawings (if applicable)		Follow-up
Staff Org chart	X	See below
Transformer / Overhead poles	X	

Staff Org chart:
11 employees -> Phil (director), admin assistant -> Miles (assist. Director) -> Chuck (OPS manager)-> 2 electricians, 2 mechanics, 3 ops/maintenance

Notes for C&S Team

- Bring multi-modal concept drawing for airport consideration
- Bring map to mark and understand feasibility of locations
- If applicable, drive around to assess feasible locations

Comments

- **Grants submission for Multimodal w/ Western Michigan**
- **Justine Johnson (came to visit) – Michigan's Chief Mobility Officer**
    - **OFME- Office of future mobility electrification**
- **$7 million received from the state (not MDOT)**
    - **Airspace, electrification studies, prep for development (studies/ planning) not construction or full design.**
- **Email Phil with any requests**

Multimodal Charging Station Site-Visit Checklist

November 2023

Airport Name: Gerald R Ford International Airport

Airport Identifier: GRR

Airport Location: Grand Rapids, Michigan

Site-Visit Date: 11/20/2023

Questions		Notes
Primary contact for airport?		**Jim Weiler**
Engineering contact for airport?		**Jim Weiler**
Who is the utility provider? Point of contact?		Consumers David Zokoe – 616-430-7757 They meet with him and 2 other people each month Also systems engineer and field supervisor He presented with Corey in Traverse City He would be excited about
Do you have your own utility loop? (A substation on site and everything you manage thereafter)	**Y / N**	**Yes they have their own loop** **3 substations on or near the airport (see ALP)** **In some places it would be easy to add on to their loop,** **Fully redundant airport generated power** **They have a monthly meeting with Consumers Energy**
Known current electrical capacity?		See survey

Questions		Notes
Do you currently have EV charging stations?	Y / N	**8 in the parking lot 4 in employee parking lot** **Currently free power** **Paying short term rate** **Employee lot you have to have an account (8-10 hours of charging)**
Have you looked into funding for EV chargers? (What have collaborations with charging providers looked like?)	Y / N	**10 in place are airport paid, no federal or state grants used** **Have gotten Consumers rebates** **Active grant for airport fleet investment**
What do you expect for EV traffic?		For airfield – driven by FLITE program They have looked at autonomous security, mowing, etc. Can send more info on FLITE Year old data for public parking – 90 charges in a month, 6 hours 5 spaces used at once is max Generated $1,000 in a month and paid $66 in power A lot of interest in EV chargers Maybe in economy lot? No eVTOL on ALP yet MDOT/Linn's group came out and flew the drone
Are there any hotspots on the airfield?	Y / N	**PFAS in the dirt adjacent to location #3** **See ALP for airfield hotspots** **Due care plan for PFAS is to keep on site**
Are there any possible obstructions to approach surfaces?	Y / N	**No major concerns for most, not sure on #8**
Is airport property constrained by a natural or physical barrier? (i.e., water ways, wildlife habitats)	Y / N	**East side river** **Highway on north and south** **Industry to the west**
Are there space/expansion constraints (i.e., open space for solar fields)?	Y / N	**Solar on the parking deck roof – was going to cost $100,000 per year** **They haven't decided if they want to pay for this**

Questions		Notes
		Sustainability management plan will be done next summer – looking at business case for this
Are there other plans for this space?	**Y / N**	**#1 and #2, #3– this type of development fits #4,#5, #8 and #9 no competition #6 and #7 potential FBO Partnership could be great with Avflight or other FBO**
Do you have an ARFF? (Who responds to a fire?)	**Y / N**	**YES**
Are you handling cargo? (How/where is it located?)	**Y / N**	**YES – FedEx and UPS Building 401 and 402 Only ground side for UPS FedEx has a flight in**
Can we request a new facility service?	**Y / N**	**YES**
Is public transportation available to the airport?	**Y / N**	**Yes there is a bus stop – 18 hours a day Serves the terminal/school/tenants large transfer**
Is maintenance information kept in a software/database system?	**Y / N**	**Cityworks – starting to use that in December, integrating all maintenance and Part139 Mpulse being used not**
Do airport staff/airport sponsor have knowledge on Advanced Air Mobility (AAM)? (Is there interest for a vertiport at the airport?)	**Y / N**	**Yes operations staff involved AAAE working group They ask questions about how they should be planning for it**
Would staff be available to oversee vertiport activities? (How many full-time airport staff are there?)	**Y / N**	**FBO would handle this Or procure a new operator 120 staff – 140 with part time**

Data	Photos (X if applicable)	Notes
Airport Layout Plan		Complete, in F-Drive
Existing conditions, grading, natural elements	X	
Master plans for future expansion		
Utility locations	X	
Nearby equipment	X	
One-line diagrams and panel schedules		
Utility loop drawings (if applicable)		Jim can get us this
Staff Org chart		
Transformer / Overhead poles	X	

Notes for C&S Team

- Bring multi-modal concept drawing for airport consideration
- Bring map to mark and understand feasibility of locations
- If applicable, drive around to assess feasible locations

Comments

They have all of the capacity they would need for anything we want to do, and Consumers would be excited to help out

Multimodal Charging Station Site-Visit Checklist

November 2023

Airport Name: Capital Region Airport

Airport Identifier: LAN

Airport Location: Lansing, Michigan

Site-Visit Date: 11/27/2023

Questions		Notes
Primary contact for airport?		**Rob Benstein**
Engineering contact for airport?		**Ron O'Neil**
Who is the utility provider? Point of contact?		Consumers Lansing Board of Water and Light (center of runway
Do you have your own utility loop? (A substation on site and everything you manage thereafter)	**Y / N**	**Yes loop, substation no**
Known current electrical capacity?		In the survey
Do you currently have EV charging stations?	**Y / N**	**No chargers at the moment – 4 going in the short-term parking for public. They have thought about ops/maintenance vehicles in about 2027**
Have you looked into funding for EV chargers? (What have collaborations with charging providers looked like?)	**Y / N**	**They are funding the EV chargers themselves – don't meet criteria for distance to highway (1.6 Miles)**

Questions		Notes
What do you expect for EV traffic?		UPS – future aircraft need Car rental companies – this is a big need, they will use the ones being added in short term parking (hard to get them electrical service) Customers will utilize it for parking while flying
Are there any hotspots on the airfield?	Y / N	**Txy C/M – 6/24 and main runway**
Are there any possible obstructions to approach surfaces?	Y / N	**No issues with the locations they have proposed**
Is airport property constrained by a natural or physical barrier? (i.e., water ways, wildlife habitats)	Y / N	**Cemetery to the west** **I-96 business to the south**
Are there space/expansion constraints (i.e., open space for solar fields)?	Y / N	**45-acre area isn't buildable or farmable on the north side – thinking about solar farm here**
Are there other plans for this space?	Y / N	**They already have plans to make this happen – they need to take care of tenants**
Do you have an ARFF? (Who responds to a fire?)	Y / N	**Yes**
Are you handling cargo? (How/where is it located?)	Y / N	**Yes**
Can we request a new facility service?	Y / N	**Would not need to do this with a new service, plenty of power. They would bring in new transformers.**
Is public transportation available to the airport?	Y / N	**Yes CATA is here** **They are looking at on-demand to university and downtown (hotels and capital)**
Is maintenance information kept in a software/database system?	Y / N	**Yes - Impulse**
Do airport staff/airport sponsor have knowledge on Advanced Air Mobility (AAM)? (Is there interest for a vertiport at the airport?)	Y / N	**Yes and yes**

Questions		Notes
Would staff be available to oversee vertiport activities? (How many full-time airport staff are there?)	Y / N	**FBO activities – airport would maintain**

Data	Photos (X if applicable)	Notes
Airport Layout Plan		Complete, in F-Drive
Existing conditions, grading, natural elements	X	
Master plans for future expansion		Airport is working on overall master plan for airport Plans for national guard to have a new entrance and new armory. They are bringing another division here. Need to address lack of facilities for females.
Utility locations	X	Double ended – 2 services coming to the terminal
Nearby equipment	X	
One-line diagrams and panel schedules		One line of terminal available if we need it Airfield lighting comes to the terminal
Utility loop drawings (if applicable)		Navaids to the east have Consumers Navaids to the west have BPL
Staff Org chart		42 staff now (they can share org chart)
Transformer / Overhead poles	X	

Notes for C&S Team

- Bring multi-modal concept drawing for airport consideration
- Bring map to mark and understand feasibility of locations
- If applicable, drive around to assess feasible locations

Comments

First quarter of 2025 master plan complete

Martin Air already transitioning into looking at electric aircraft – for cargo service, feeder for

---

They have met with Beta, included MEDC, AvFlight. Partnership with Avflight and UPS

National Guard headquarters here, they are part of the discussion
UPS has 65 on order now

Looking at a solar farm and

---

470 acres on the north side for land development
UPS is primarily all next day air
Amazon leases some space
Amazon has 1M sq foot facility going in
They just added 7 football fields of ramp space
Working with Board of Water and light on utility project – economic development grant
Niowave – manufacturing isotops, they are building 2 more buildings (3rd building will house cancer fighting drug, only 3 in the US) – breaking ground next year
Earmarks from state and feds
National guard have a project getting started
LCC eliminating 4 hangars – demo, env cleanup already done
Corporate hangars going in
Location for chargers: Martin air
UPS pilot program for tugs to use electric GSE
Design $8M for LAN terminal – $120M terminal, improve aesthetics,
$2M for mason terminal
$200,000 for utility
MartinAir now owned by X wing – they want to work with UPS
MDOT discussion – some of this information is confidential, make sure that is clear

Land line – bus service airside to airside – Philly, Atlantic City – relationships with American (not with Delta), checked bags transfer,
Airports won't support bus to bus service – lost revenues, PFCs, can't have loss of passenger numbers
Discussions with CATA
Airport in 3 counties

Multimodal Charging Station Site-Visit Checklist

November 2023

Airport Name: Cherry Capital Airport

Airport Identifier: TVC

Airport Location: Traverse City, Michigan

Site-Visit Date: 11/28/2023

Questions		Notes
Primary contact for airport?		**Bob**
Engineering contact for airport?		**Bob**
Who is the utility provider? Point of contact?		Jake Hardy is also the contact for e-boats
Do you have your own utility loop? (A substation on site and everything you manage thereafter)	**Y / N**	**Nobody else on loops**
Known current electrical capacity?		See electrical study that was uploaded
Do you currently have EV charging stations?	**Y / N**	**2 going in short term, ability to expand** **Hertz is investigating EV chargers as well.** **2 chargers for Gems**

Questions		Notes
		EVs in general - Not as successful with trucks – buy American can't be met, manufacturers won't provide the information
Have you looked into funding for EV chargers? (What have collaborations with charging providers looked like?)	**Y / N**	**Yes – Jake is looking at grants and green coast electrification** **Solar and storage for parking that we worked on (Corey Johnson)**
What do you expect for EV traffic?		Increasing EV use, especially rentals Someone has suggested eVTOL FBO Airline ground equipment expected With terminal expansion – need to have space for eGSE Utility demand study being worked on by MTU – TVC is high adoption area based on current adoption and demographics Avflight has shown some interest
Are there any hotspots on the airfield?	**Y / N**	**No FAA hotspots**
Are there any possible obstructions to approach surfaces?	**Y / N**	**No issues in the p** **18 approach has trees in the cemetery**
Is airport property constrained by a natural or physical barrier? (i.e., water ways, wildlife habitats)	**Y / N**	**Mitchell creek to the south and east** **Bay to the north** **Lake to the west** **No major wetlands**
Are there space/expansion constraints (i.e., open space for solar fields)?	**Y / N**	**Yes see plan**
Are there other plans for this space?	**Y / N**	**Yes**
Do you have an ARFF? (Who responds to a fire?)	**Y / N**	**Yes**
Are you handling cargo? (How/where is it located?)	**Y / N**	**FedEx/UPS** **They haven't asked about using eVTOLs yet** **Amazon**
Can we request a new facility service?	**Y / N**	**Yes they can**

Questions		Notes
Is public transportation available to the airport?	Y / N	**BETA comes here – bus stop at the terminal. In the summer they will take people downtown. They also have on-demand services. Hotel shuttles. Cabs and Ubers as well. Turo is here.**
Is maintenance information kept in a software/database system?	Y / N	**No not currently, they are working on getting one in 2024**
Do airport staff/airport sponsor have knowledge on Advanced Air Mobility (AAM)? (Is there interest for a vertiport at the airport?)	Y / N	**Yes and yes** **Preliminary discussions with FBO**
Would staff be available to oversee vertiport activities? (How many full-time airport staff are there?)	Y / N	**Would expect FBO to operate it**

Data	Photos (X if applicable)	Notes
Airport Layout Plan		Complete, in F-Drive
Existing conditions, grading, natural elements	X	
Master plans for future expansion		
Utility locations	X	They can give us a utility plan
Nearby equipment	X	
One-line diagrams and panel schedules		
Utility loop drawings (if applicable)		
Staff Org chart		
Transformer / Overhead poles	X	

Notes for C&S Team

- Bring multi-modal concept drawing for airport consideration
- Bring map to mark and understand feasibility of locations

- If applicable, drive around to assess feasible locations

Comments

Are they going to want to have one commercial service and one GA?
Will there be coordination with the college
MTU has a research facility in downtown Traverse City – electrical engineer, studying electrical demand
Size of utilities – Cherry Land and TCLP, viewed as good partners, more nimble and flexible than the big companies
Power companies are wondering what future demand looks like
Traverse Connect – economic development for the region
Jake with TCLP
Distributed storage – are they thinking about this?
BVLS drone study, TVC is on the list for this as well for test pilot
Office of future mobility and MEDC – grant program for marine electrification
Big enough to be impactful, small enough to work together
Eboat demo day
First place in North America to have an eboat corridor
"Accessibly remote"
Justine Johnson – can we get an intro

Multimodal Charging Station Site-Visit Checklist

November 2023

Airport Name: Willow Run Airport

Airport Identifier: YIP

Airport Location: Ypsilanti, MI

Site-Visit Date: 11/17/2023

Questions		Notes
Primary contact for airport?		**John Philbrook**
Engineering contact for airport?		**Derek Lawton but use John first**
Who is the utility provider? Point of contact?		2 primary services on the west side DTE – Carrie, but she will be leaving at the end of the month
Do you have your own utility loop? (A substation on site and everything you manage thereafter)	**Y / N**	**No** **250'x250' for substation – they discussed the possibility of adding a substation with all of the work going on**
Known current electrical capacity?		They will have to get back to us on this. If not current capacity they would be able to bring service in.
Do you currently have EV charging stations?	**Y / N**	**None at the airport** **May be some at FBOs or others they are not aware of**
Have you looked into funding for EV chargers? (What have collaborations with charging providers looked like?)	**Y / N**	

Questions		Notes
What do you expect for EV traffic?		No demand right now
Are there any hotspots on the airfield?	Y / N	**No – there were 2 but they took care of them**
Are there any possible obstructions to approach surfaces?	Y / N	**Last obstruction study done in 2021 – they stay on top of tree clearing**
Is airport property constrained by a natural or physical barrier? (i.e., water ways, wildlife habitats)	Y / N	**Landfill and I-94 to the south** **Own land on the north past Ecorse** **A little room on the east**
Are there space/expansion constraints (i.e., open space for solar fields)?	Y / N	**None at this time – looking for direct aeronautical development**
Are there other plans for this space?	Y / N	**There are some plans but it's open for development**
Do you have an ARFF? (Who responds to a fire?)	Y / N	**Yes fire station #4**
Are you handling cargo? (How/where is it located?)	Y / N	**Yes – Kalitta, Ameristar and Active Aero/USA Jet all handle cargo**
Can we request a new facility service?	Y / N	**Yes this can be requested but maybe not needed – they will rebuild existing service or upgrade – Wouldn't likely need another primary service**
Is public transportation available to the airport?	Y / N	**Shuttle service for pilots going to hotels and car rentals** **No public transportation currently**
Is maintenance information kept in a software/database system?	Y / N	**Yes use Maximo**

Questions		Notes
Do airport staff/airport sponsor have knowledge on Advanced Air Mobility (AAM)? (Is there interest for a vertiport at the airport?)	**Y / N**	**Michael has been to drone conference and some talk about it but no current talk about adding**
Would staff be available to oversee vertiport activities? (How many full-time airport staff are there?)	**Y / N**	**No, staff is limited They would expect the FBO to handle it**

Data	Photos (X if applicable)	Notes
Airport Layout Plan		Complete, in F-Drive- they have a more recent one that Michael can send us. He gave us master plan
Existing conditions, grading, natural elements	**X**	
Master plans for future expansion		Nothing beyond airport master plan Lots of development going on, new hangars
Utility locations	**X**	
Nearby equipment	**X**	
One-line diagrams and panel schedules		Could get these if needed from PD&C
Utility loop drawings (if applicable)		
Staff Org chart		
Transformer / Overhead poles	**X**	

Notes for C&S Team

- Bring multi-modal concept drawing for airport consideration
- Bring map to mark and understand feasibility of locations
- If applicable, drive around to assess feasible locations

Comments

Kallita and Aerostar on south ramp – likely not in this location
Hangar 1 is shutting down – ATP flight school is there still, they need a buyer for this building
85% of airport tenants are on the east side
Avflight and
No development on the north side per FAA
3 hangars on the west

International turbines, Rouch, and ATP flight school on west side
Access study taking place – looking at access to I-94
13.2 service currently being brought in for new hangar, trying to get away from 4.8 service
2 primary services east side are powering the buildings
2 primary services west side are powering the airfield
5-24 months
1500 amps (480 V) is line between secondary service and primary service

2 DTE reps (Carrie and ?), John, Michael

Appendix E:
AAM Operator and Manufacturer Survey Responses

AAM Operator and Manufacturer Survey Responses

The following AAM Operators and Manufacturers were contacted as part of this survey (listed alphabetically):

- Archer Aviation, Inc.
- Beta Technologies
- Bristow
- Eve Air Mobility
- Ferrovial
- Joby Aviation
- Skyports
- Supernal
- Volatus Infrastructure
- UPS Flight Forward

The following questions were sent to AAM Operators and Manufacturers for their response via email, responses were received from seven of the ten manufacturers and operators, with one declining to provide responses:

1. *Please rank your top three Michigan airports from this short-list. If it were up to your organization, which airports would receive preference for chargers?*
2. *Looking at your ranking, what are the reasons for selecting your top-three?*
3. *Do you have any current or future plans for coordination or operations in the State of Michigan or, in its bordering states?*
4. *We want to foster AAM growth and development! Do you have any recommendations for MDOT on placing chargers within the State of Michigan that might bolster your operations and charging network?*

Question 1 Responses:

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
Not Provided	Not Provided	ARB	YIP	LAN	GRR	LAN
		BTL	ARB	TVC	ARB	YIP
		TVC	LAN		LAN	BTL

AAM Operator and Manufacturer Survey Responses

Question 2 Responses: *Looking at your ranking, what are the reasons for selecting your top-three?*

AAM Operator and Manufacturer Respondents cited the following reasons for their rankings:

- Respondent 1: Response not provided
- Respondent 2: Response not provided
- Respondent 3: ARB is valuable due to density/activity from the University.
- Respondent 3: BTL provides an opportunity to show operational success at an Executive field.
- Respondent 3: TVC provides an opportunity to supplement ferry service for the Great Lakes Basin.
- Respondent 4: An aim to operate Urban Air Mobility In high-density areas and viewing of the area from Lansing, through Detroit and Northern Ohio as one region
- Respondent 5: LAN-TVC is a current route in operator's existing small feeder aircraft network. This increases the likelihood of future operations involving a charging station.
- Respondent 6: Potential traffic and concerns for weather make the selected airports most likely candidates for operation.
- Respondent 7: Aim to build a bit of a cross Michigan network, but also to incorporate the most forward leaning airports in terms of AAM. We specifically are targeting early freight locations and LAN and YIP have a significant presence in this arena with partners like UPS and others both current and potential.

For those respondents that did not provide a ranking, cited reasons for their decision included a company focus on high volume air taxi/ urban locations outside of Michigan, and a lack of plans for coordination outside the state of Michigan.

Question 3 Responses: *Do you have any current or future plans for coordination or operations in the State of Michigan or, in its bordering states?*

Of the five respondents who provided detailed responses on their present and future plans for AAM operation in Michigan both Lansing and Detroit were cited as cities planned for AAM development and operation. Bordering states were also cited by respondents including coordination in Wisconsin and Ohio as well as targeted plans in the City of Chicago. The remaining two respondents reported no plans for present or future AAM operation in the State of Michigan.

Question 4 Responses: *Do you have any recommendations for MDOT on placing chargers within the State of Michigan that might bolster your operations and charging network?*

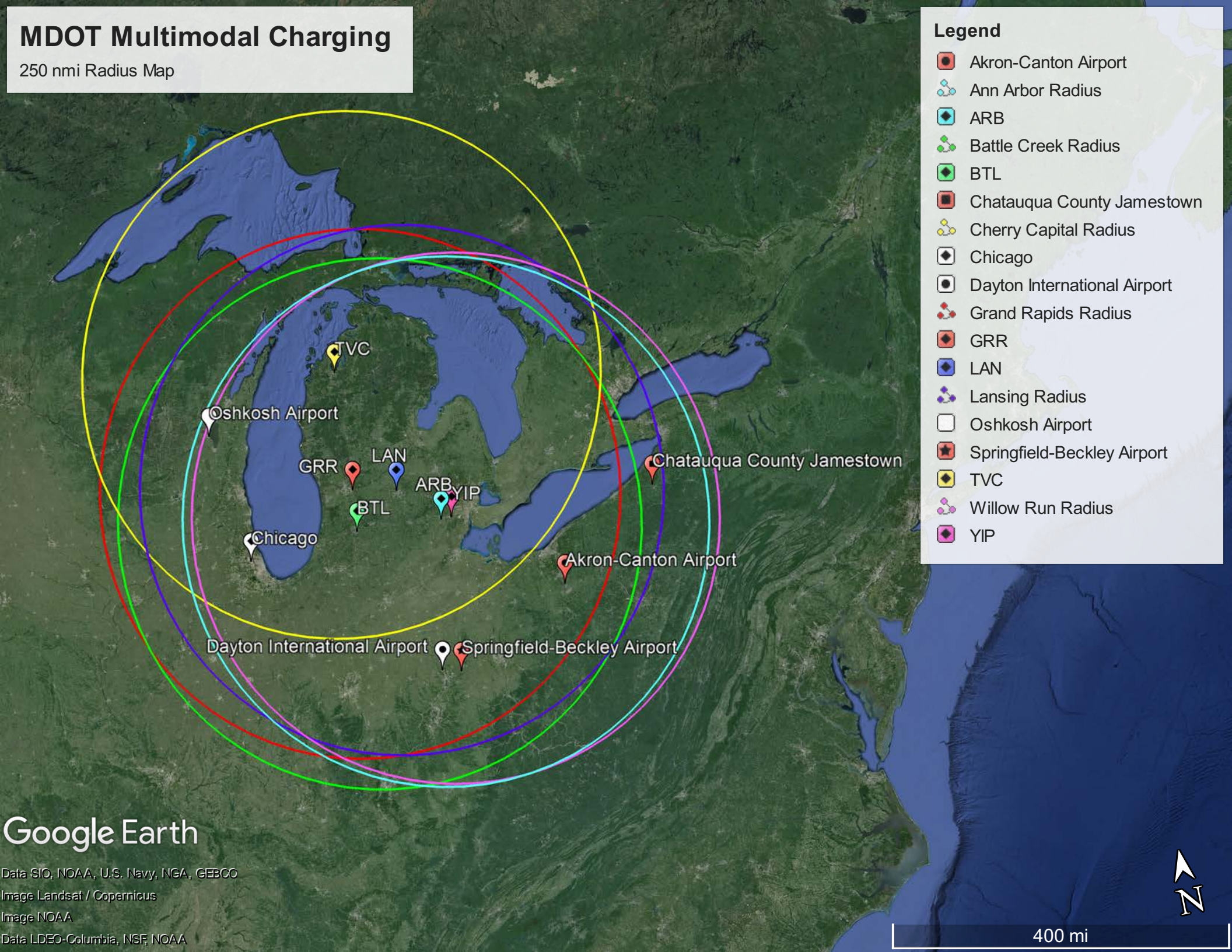
Respondent recommendations for MDOT included:

- Planning for charging interoperability as a key priority

AAM Operator and Manufacturer Survey Responses

- Working to ease coordination between airports and utilities to minimize long lead times on ALP updates and updates to the utility and grid
- Considerations for both stabilizing and expanding the electrical capacity of the grid
- Centering weather concerns and limitation in MDOT decision-making by prioritizing locations in the south and east of the state
- Locating chargers within existing ramp space at airports for AAM/eVTOL operation
- Support from MDOT in utilization of public funds for AAM via grants, loans, and public programming.

Appendix F:
MDOT Mulitmodal Charging 250 NM Radius Map


MDOT Multimodal Charging
250 nmi Radius Map
Legend
Akron-Canton Airport
Ann Arbor Radius
ARB
Battle Creek Radius
BTL
Chatauqua County Jamestown
Cherry Capital Radius
Chicago
Dayton International Airport
Grand Rapids Radius
GRR
LAN
Lansing Radius
Oshkosh Airport
Springfield-Beckley Airport
TVC
Willow Run Radius
YIP
TVC
Oshkosh Airport
GRR
LAN
ARB
YIP
BTL
Chicago
Chatauqua County Jamestown
Akron-Canton Airport
Dayton International Airport
Springfield-Beckley Airport
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Image NOAA
Data LDEO-Columbia, NSF, NOAA
N
400 mi

Appendix G:
Equity Analysis Report

C&S Engineers, Inc.
38777 Six Mile Rd. Suite 202
Livonia, MI 48152

Multimodal Airport Charging Station Deployment – Phase 1
Equity Analysis Report

Michigan Department of Transportation

Prepared by:
C&S Engineers, Inc.

January 2024

Table of Contents

1.1 Introduction

The expansion of multimodal airport charging stations across Michigan will be a landscape of change. In determining the optimal location for the State's forthcoming multimodal airport charging station, it is crucial to employ an environmental equity lens during the project planning phase. Doing so will ensure a comprehensive understanding of potential impacts on, or benefits to, existing disadvantaged communities arising from the proposed multimodal charger. The decision to prioritize the placement of a multimodal charging station, catering to ground vehicles and aircraft, in either a predominantly disadvantaged or privileged area necessitates a thoughtful consideration of various factors. Below are some advantages and disadvantages to weigh for both options.

1.2 Equity Analysis Summary

C&S Companies completed an equity screening for this Project by cross referencing granular data from the EPA's Environmental Justice (EJ) Screening and Mapping Tool (EJ Screen) and additional screenshots from MiEJScreen, an interactive screening tool that identifies Michigan communities that may be disproportionately impacted by environmental hazards. The equity screening was conducted for the 3-mile radius around each of the six shortlisted airports and included data for various pollution sources, critical service gaps, and climate, health, and socioeconomic indicators (See Attachment 1 for individual equity reports).

C&S used the EPA's EJ Screening tool for the bulk of the equity analysis. EJ Screen is specifically designed to identify communities that may be disproportionately burdened by environmental pollution and other hazards. It helps analyze and visualize data related to environmental and demographic factors, allowing users to identify areas with a higher likelihood of environmental justice concerns. These factors include air and water quality, demographic characteristics, socioeconomic status, and potential environmental hazard.

Based on the completed equity analysis (See Attachment 2), the airports have been ranked from least disadvantaged to most disadvantaged:

1. Ann Arbor Municipal and Gerald R. Ford International
2. Cherry Capitol
3. Battle Creek Executive
4. Capitol Region International
5. Willow Run

The decision to place charging infrastructure in a predominantly disadvantaged community can be interpreted in contrasting ways, each with its own set of potential benefits and drawbacks. On one hand, siting in a disadvantaged area is seen as a positive step, addressing transportation equity and fostering accessibility in regions that lack sustainable resources. The potential benefits include positive community impact through job creation and local economic development, alignment with environmental justice principles, and a commitment

to community engagement. On the other hand, challenges such as infrastructure limitations, lower adoption rates of electric vehicles, and concerns about financial viability may arise. Conversely, placing the equipment in an economically advantaged area has its own merits, including higher adoption rates, enhanced financial viability, and improved infrastructure readiness. However, this approach may raise equity concerns, miss opportunities for positive impact in disadvantaged communities, and be negatively perceived by the broader public. The situation likely resides in a grey area, necessitating a careful consideration of both perspectives to strike a balance that acknowledges and addresses the complex interplay of equity, economic factors, and environmental justice.

1.3 Placing equipment in a predominantly disadvantaged area:

The potential benefits:

- Equity and Accessibility: Addresses transportation equity by providing sustainable infrastructure in areas that may have limited access to such resources.
- Community Impact: Positively impacts the community by creating job opportunities and contributing to local economic development.
- Environmental Justice: The decision to place multimodal charging infrastructure aligns with environmental justice principles by addressing the disproportionate impact of pollution and emissions on disadvantaged communities.
- Community Engagement: Demonstrates a commitment to community engagement and empowerment by involving local residents in the decision-making process.

The potential drawbacks:

- Infrastructure Challenges: Disadvantaged areas may face infrastructure challenges, such as outdated grids, which could pose difficulties for installing and maintaining charging stations.
- Lower Adoption Rates: Lower adoption rates of electric vehicles in disadvantaged areas may result in underutilization of the charging infrastructure.
- Financial Viability: The economic viability of the charging station may be a concern if the area has a lower overall economic capacity.

1.4 Placing equipment in an economically advantaged area:

The potential benefits:

- Higher Adoption Rates: Less disadvantaged areas may have higher adoption rates for electric vehicles, ensuring more consistent use of the charging infrastructure.
- Financial Viability: Increased economic capacity in less disadvantaged areas may contribute to the financial sustainability of the charging station.

- Infrastructure Readiness: Less disadvantaged areas are more likely to have better infrastructure readiness, reducing challenges related to installation and maintenance.

The potential drawbacks:

- Equity Concerns: May contribute to existing disparities by concentrating resources in already privileged areas, potentially exacerbating social and economic inequalities.
- Missed Opportunity for Impact: Misses the opportunity to address environmental justice concerns and contribute to positive change in disadvantaged communities.
- Community Perception: May be perceived negatively by the broader public if there's a perception of favoring privileged areas over those in need. Airport Master Plan Update (2008)

1.5 Maximizing Equity in MDOT's Siting Location

To best maximize equity in MDOT's siting locations for charging stations, a series of recommendations are proposed to foster a more inclusive and balanced approach. These suggestions are crafted to address both equity concerns and the economic viability of charging stations, emphasizing the importance of community involvement, leveraging incentives, and considering the long-term impacts of the projects. By considering and adopting these measures, MDOT can strive towards a collaborative and thoughtful decision-making process that harmonizes the unique circumstances of each location, ensuring a holistic and equitable deployment of charging infrastructure.

1.5.1 Design a Holistic Approach

- Strive for a balanced approach that considers both equity concerns and the economic viability of the charging stations. This might involve a mix of placements, strategically distributed across various communities, to ensure accessibility without compromising financial sustainability.
- Aim to optimize regional coverage, taking into account not only urban but also rural and suburban areas. This approach can contribute to a more comprehensive and inclusive network that serves diverse communities.

1.5.2 Involve Community Input

- Conduct a thorough needs assessment by engaging with local communities. Seek input from residents, businesses, and community organizations to understand their specific requirements, preferences, and concerns related to the charging station.
- Organize community workshops or forums to facilitate open dialogue. This ensures that the project aligns with the community's values and addresses any potential challenges or opportunities from the perspective of those directly affected.

1.5.3 Identify Regional, State, and Federal Incentives

- Explore and leverage available government incentives and support mechanisms, especially in disadvantaged areas. This could include tax credits, grants, or subsidies that make the implementation of charging stations financially feasible in regions that may face economic challenges.
- Investigate opportunities for public-private partnerships that align with government initiatives, fostering collaboration to enhance the reach and impact of the charging infrastructure.

1.5.4 Consider The Project as a Long-Term Investment

- Evaluate the long-term environmental impact of the charging station deployment. Consider factors such as reduced carbon emissions, improved air quality, and contributions to overall environmental sustainability goals.
- Assess the broader impact on community development over an extended period. This includes potential job creation, increased local business opportunities, and the overall enhancement of the quality of life in the surrounding areas.

Ultimately, the decision should be made through a collaborative and thoughtful process that considers the unique circumstances of each location and aims to balance equity, environmental impact, and economic considerations.

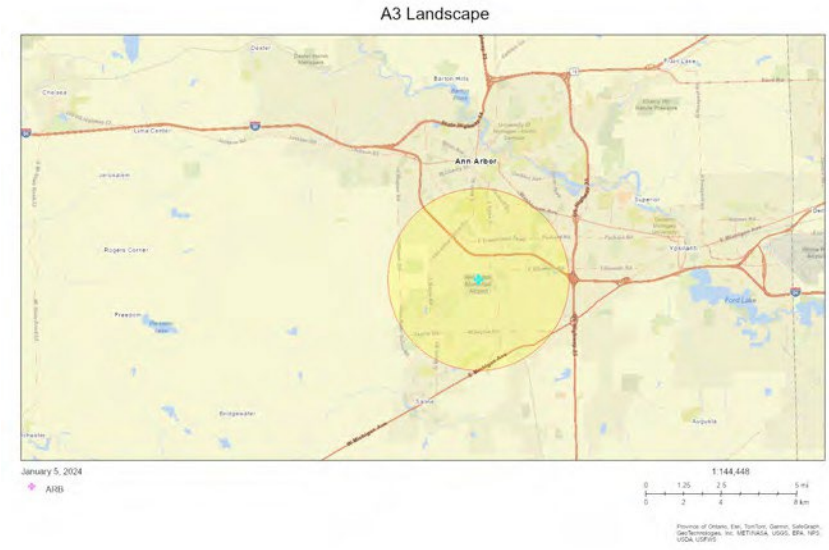
Attachment 1. Individual EPA EJScreen Reports

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Washtenaw County, MI

3 miles Ring Centered at 42.225347,-83.746676
Population: 50,472
Area in square miles: 2 . 7



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	78%
Spanish	3%
French, Haitian, or Cajun	1%
German or other West Germanic	1%
Russian, Polish, or Other Slavic	1%
Other Indo-European	4%
Korean	1%
Chinese (including Mandarin, Cantonese)	5%
Other Asian and Pacific Island	2%
Arabic	2%
Other and Unspecified	1%
Total Non-English	22%

COMMUNITY INFORMATION

- Low income: 22 percent
- People of color: 30 percent
- Less than high school education: 3 percent
- Limited English households: 5 percent
- Unemployment: 3 percent
- Persons with disabilities: 8 percent
- Male: 49 percent
- Female: 51 percent
- 68 years — Average life expectancy
- $45,870 — Per capita income
- Number of households: 21,913
- Owner occupied: 58 percent

BREAKDOWN BY RACE

- White: 70%
- Black: 7%
- American Indian: 0%
- Asian: 13%
- Hawaiian/Pacific Islander: 0%
- Other race: 0%
- Two or more races: 5%
- Hispanic: 5%

BREAKDOWN BY AGE

From Ages 1 to 4	5%
From Ages 1 to 18	18%
From Ages 18 and up	82%
From Ages 65 and up	16%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	2%
Speak Other Indo-European Languages	9%
Speak Asian-Pacific Island Languages	65%
Speak Other Languages	24%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

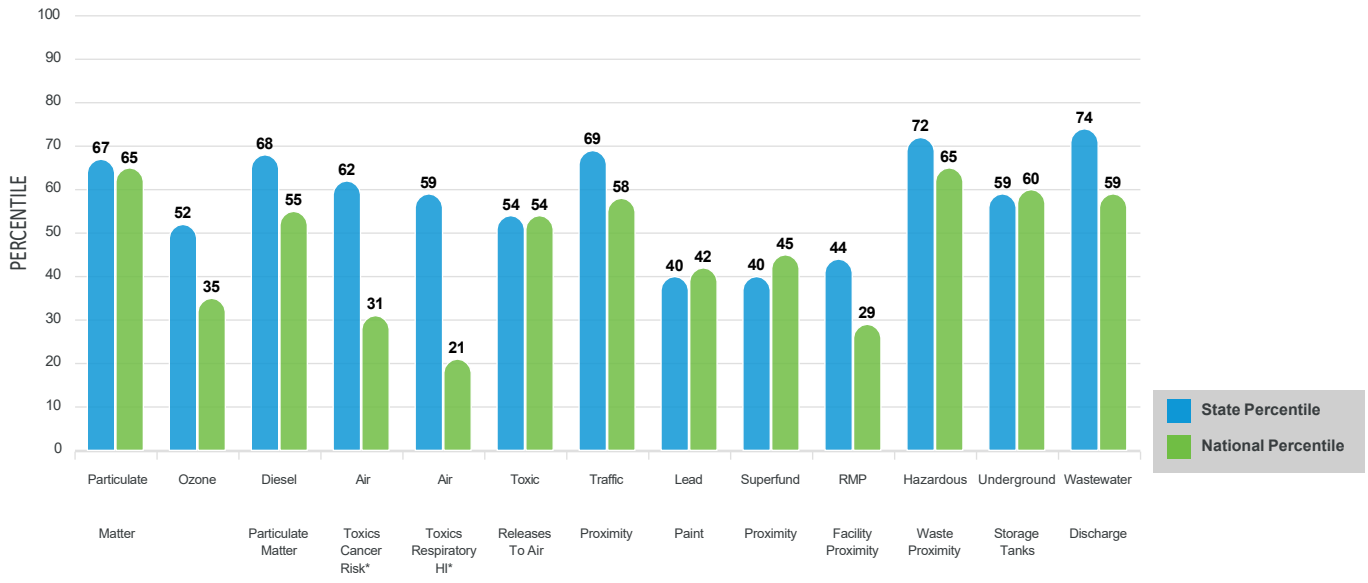
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen re ecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

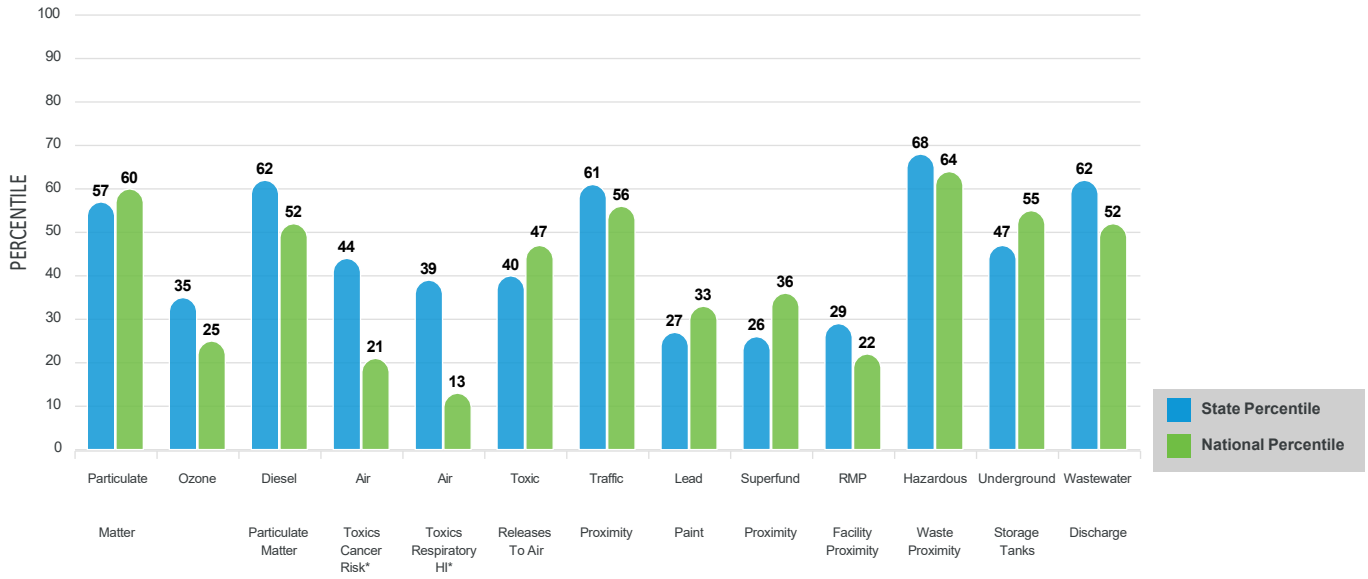
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community level vulnerability. They combine data on percent low income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 3 miles Ring Centered at 42.225347,-83.746676

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8.96	8.51	58	8.08	72
Ozone (ppb)	58.4	60	35	61.6	27
Diesel Particulate Matter (µg/m^3)	0.232	0.183	67	0.261	53
Air Toxics Cancer Risk* (lifetime risk per million)	20	19	14	25	5
Air Toxics Respiratory HI*	0.2	0.2	11	0.31	4
Toxic Releases to Air	660	2,500	38	4,600	51
Traffic Proximity (daily traffic count/distance to road)	150	120	77	210	68
Lead Paint (% Pre-1960 Housing)	0.2	0.38	34	0.3	48
Superfund Proximity (site count/km distance)	0.042	0.15	28	0.13	38
RMP Facility Proximity (facility count/km distance)	0.084	0.31	30	0.43	23
Hazardous Waste Proximity (facility count/km distance)	2.9	1.1	90	1.9	80
Underground Storage Tanks (count/km^2)	5	8	56	3.9	77
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.024	0.13	89	22	74
SOCIOECONOMIC INDICATORS					
Demographic Index	26%	28%	60	35%	44
Supplemental Demographic Index	10%	14%	34	14%	32
People of Color	30%	26%	70	39%	50
Low Income	22%	31%	40	31%	41
Unemployment Rate	3%	7%	38	6%	43
Limited English Speaking Households	5%	2%	90	5%	75
Less Than High School Education	3%	9%	24	12%	22
Under Age 5	5%	5%	56	6%	53
Over Age 64	16%	18%	48	17%	52
Low Life Expectancy	15%	20%	5	20%	10

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 5
Water Dischargers 33
Air Pollution 10
Brownfields 2
Toxic Release Inventory 9

Other community features within defined area:

Schools 15
Hospitals 0
Places of Worship 22

Other environmental data:

Air Non-attainment ..... Yes
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 3 miles Ring Centered at 42.225347,-83.746676

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	15%	20%	5	20%	10
Heart Disease	4.2	6.6	6	6.1	14
Asthma	11	11.6	39	10	77
Cancer	5.7	6.6	23	6.1	37
Persons with Disabilities	7.7%	14.6%	11	13.4%	16

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	4%	7%	40	12%	35
Wildfire Risk	0%	0%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	5%	14%	23	14%	27
Lack of Health Insurance	2%	5%	18	9%	13
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

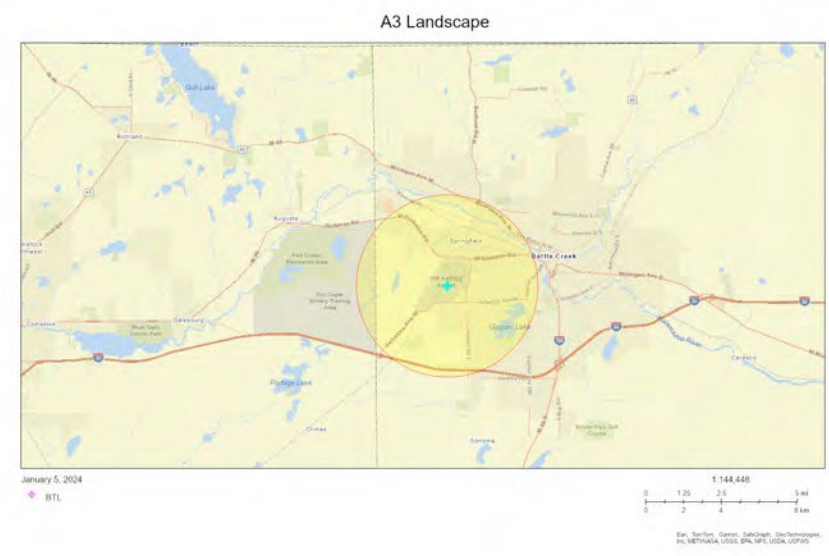
Report for 3 miles Ring Centered at 42.225347,-83.746676

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Battle Creek, MI

3 miles Ring Centered at 42.305348,-85.251272
Population: 25,439
Area in square miles: 2 . 7



COMMUNITY INFORMATION

- Low income: 40 percent
- People of color: 32 percent
- Less than high school education: 12 percent
- Limited English households: 4 percent
- Unemployment: 7 percent
- Persons with disabilities: 16 percent
- Male: 51 percent
- Female: 49 percent
- 75 years — Average life expectancy
- $26,513 — Per capita income
- Number of households: 10,591
- Owner occupied: 62 percent

BREAKDOWN BY RACE

- White: 68%
- Black: 11%
- American Indian: 0%
- Asian: 7%
- Hawaiian/Pacific Islander: 0%
- Other race: 0%
- Two or more races: 6%
- Hispanic: 7%

BREAKDOWN BY AGE

From Ages 1 to 4	6%
From Ages 1 to 18	26%
From Ages 18 and up	74%
From Ages 65 and up	14%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	26%
Speak Other Indo-European Languages	8%
Speak Asian-Pacific Island Languages	66%
Speak Other Languages	0%

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	86%
Spanish	5%
German or other West Germanic	1%
Other Indo-European	1%
Korean	1%
Other Asian and Pacific Island	5%
Total Non-English	14%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

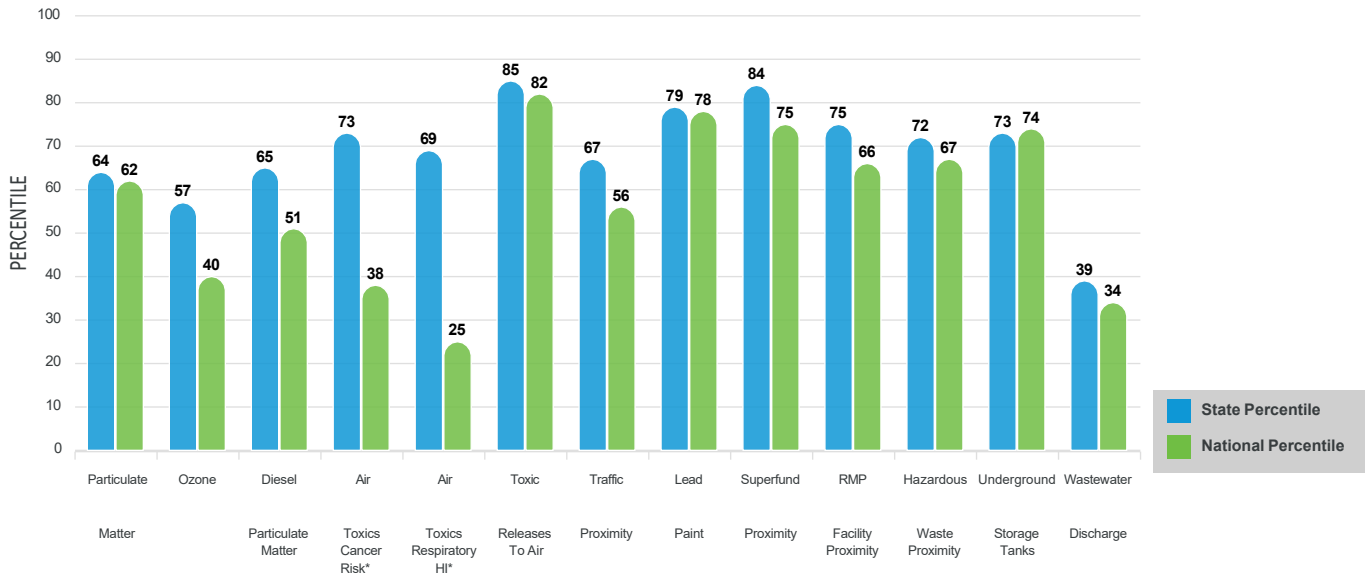
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen re ecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

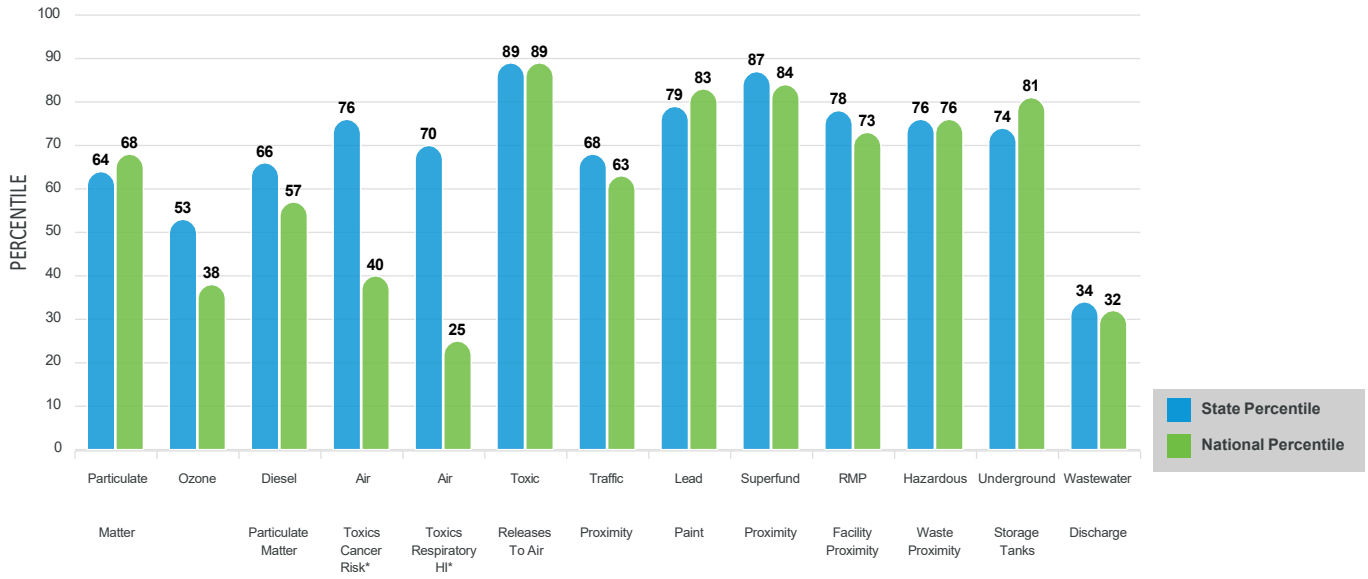
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community level vulnerability. They combine data on percent low income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 3 miles Ring Centered at 42.305348,-85.251272

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8.15	8.51	39	8.08	48
Ozone (ppb)	57.9	60	31	61.6	23
Diesel Particulate Matter (µg/m^3)	0.164	0.183	45	0.261	35
Air Toxics Cancer Risk* (lifetime risk per million)	20	19	14	25	5
Air Toxics Respiratory HI*	0.2	0.2	11	0.31	4
Toxic Releases to Air	8,800	2,500	95	4,600	92
Traffic Proximity (daily traffic count/distance to road)	66	120	51	210	46
Lead Paint (% Pre-1960 Housing)	0.56	0.38	70	0.3	77
Superfund Proximity (site count/km distance)	0.13	0.15	75	0.13	75
RMP Facility Proximity (facility count/km distance)	0.34	0.31	76	0.43	69
Hazardous Waste Proximity (facility count/km distance)	1.1	1.1	64	1.9	62
Underground Storage Tanks (count/km^2)	7.4	8	64	3.9	84
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0003	0.13	44	22	38
SOCIOECONOMIC INDICATORS					
Demographic Index	36%	28%	73	35%	60
Supplemental Demographic Index	18%	14%	75	14%	71
People of Color	32%	26%	72	39%	52
Low Income	40%	31%	70	31%	69
Unemployment Rate	7%	7%	66	6%	69
Limited English Speaking Households	4%	2%	88	5%	72
Less Than High School Education	12%	9%	73	12%	63
Under Age 5	6%	5%	66	6%	63
Over Age 64	14%	18%	39	17%	43
Low Life Expectancy	23%	20%	79	20%	83

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specifc individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one signifcant fgure and any additional signifcant fgures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 4
Water Dischargers 31
Air Pollution 20
Brownfields 22
Toxic Release Inventory 15

Other community features within defined area:

Schools 11
Hospitals 0
Places of Worship 26

Other environmental data:

Air Non-attainment ..... Yes
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 3 miles Ring Centered at 42.305348,-85.251272

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	23%	20%	79	20%	83
Heart Disease	7.2	6.6	64	6.1	71
Asthma	11.8	11.6	66	10	88
Cancer	6.6	6.6	44	6.1	57
Persons with Disabilities	14.9%	14.6%	56	13.4%	65

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	6%	7%	59	12%	49
Wildfire Risk	0%	0%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	16%	14%	63	14%	64
Lack of Health Insurance	5%	5%	53	9%	36
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for 3 miles Ring Centered at 42.305348,-85.251272

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Kent County, MI

3 miles Ring Centered at 42.885241,-85.530496
Population: 23,136
Area in square miles: 2 . 7

A3 Landscape

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	85%
Spanish	3%
German or other West Germanic	1%
Russian, Polish, or Other Slavic	4%
Other Indo-European	1%
Vietnamese	1%
Other Asian and Pacific Island	1%
Arabic	1%
Other and Unspecified	1%
Total Non-English	15%

COMMUNITY INFORMATION

- Low income: 19 percent
- People of color: 24 percent
- Less than high school education: 3 percent
- Limited English households: 1 percent
- Unemployment: 4 percent
- Persons with disabilities: 9 percent
- Male: 50 percent
- Female: 50 percent
- 66 years — Average life expectancy
- $47,518 — Per capita income
- Number of households: 9,505
- Owner occupied: 62 percent

BREAKDOWN BY RACE

- White: 76%
- Black: 10%
- American Indian: 0%
- Asian: 4%
- Hawaiian/Pacific Islander: 0%
- Other race: 0%
- Two or more races: 4%
- Hispanic: 5%

BREAKDOWN BY AGE

From Ages 1 to 4	6%
From Ages 1 to 18	23%
From Ages 18 and up	77%
From Ages 65 and up	15%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	0%
Speak Other Indo-European Languages	8%
Speak Asian-Pacific Island Languages	77%
Speak Other Languages	16%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

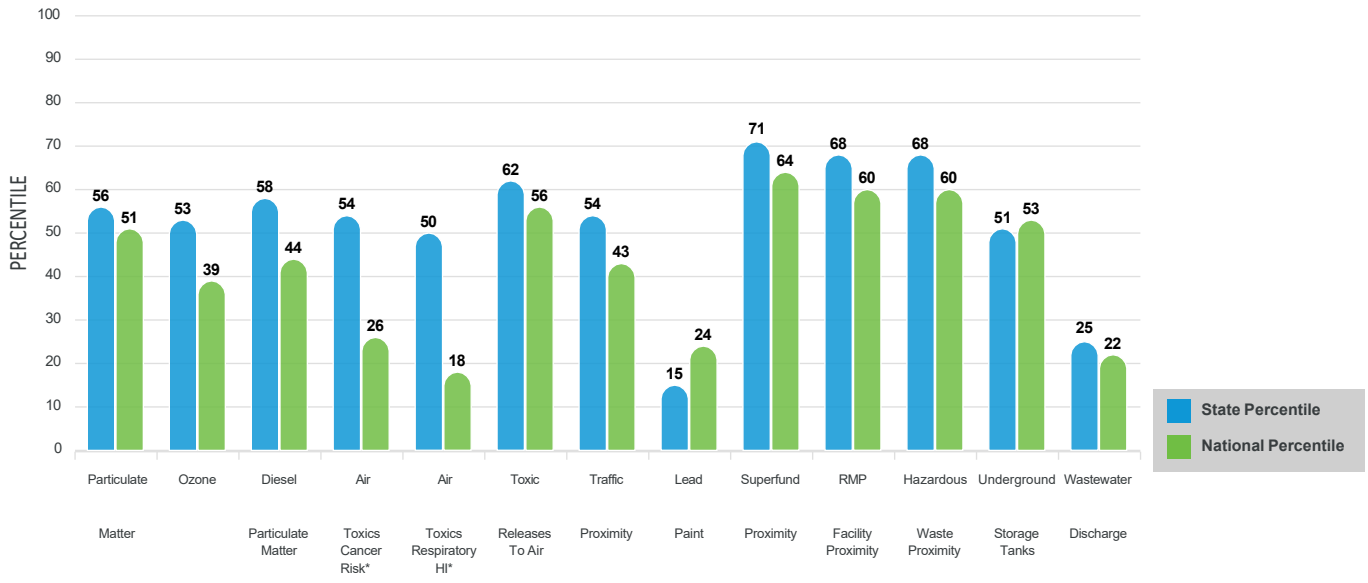
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen re ecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

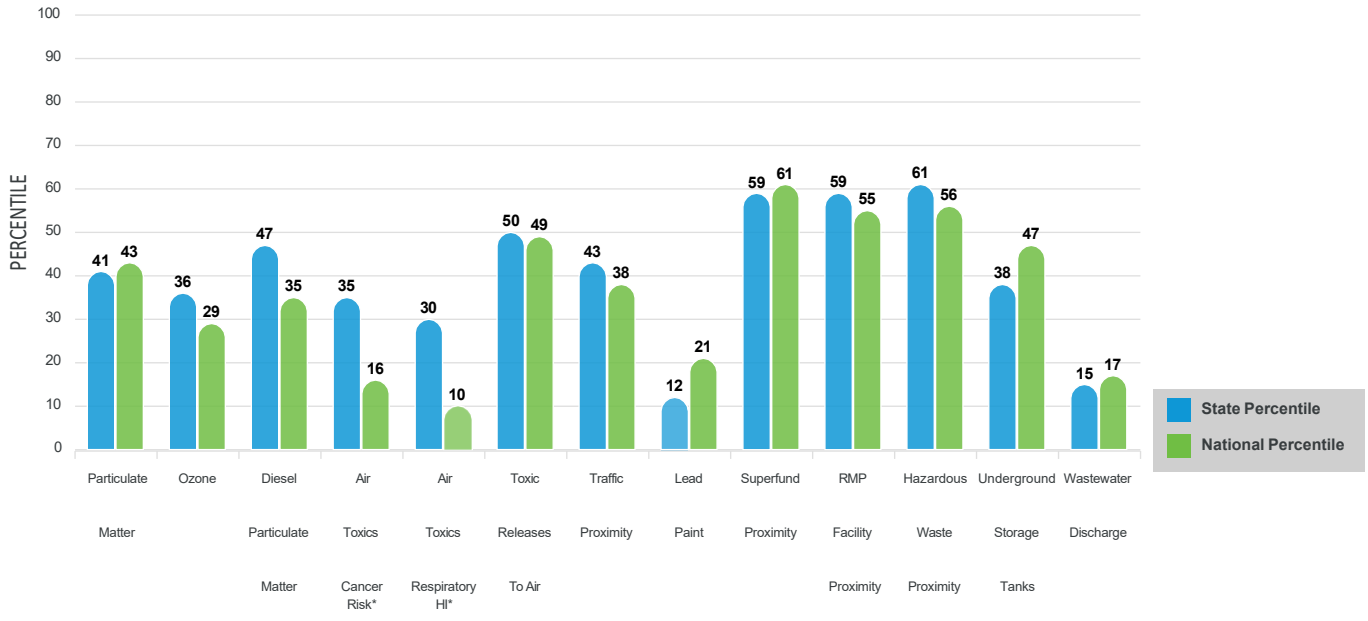
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community level vulnerability. They combine data on percent low income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 3 miles Ring Centered at 42.885241,-85.530496

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8.45	8.51	49	8.08	56
Ozone (ppb)	59.6	60	43	61.6	37
Diesel Particulate Matter (µg/m^3)	0.185	0.183	52	0.261	41
Air Toxics Cancer Risk* (lifetime risk per million)	20	19	14	25	5
Air Toxics Respiratory HI*	0.2	0.2	11	0.31	4
Toxic Releases to Air	1,500	2,500	62	4,600	67
Traffic Proximity (daily traffic count/distance to road)	73	120	54	210	48
Lead Paint (% Pre-1960 Housing)	0.043	0.38	12	0.3	24
Superfund Proximity (site count/km distance)	0.34	0.15	89	0.13	92
RMP Facility Proximity (facility count/km distance)	0.62	0.31	85	0.43	80
Hazardous Waste Proximity (facility count/km distance)	3.4	1.1	93	1.9	83
Underground Storage Tanks (count/km^2)	3	8	48	3.9	66
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00011	0.13	32	22	31
SOCIOECONOMIC INDICATORS					
Demographic Index	21%	28%	49	35%	35
Supplemental Demographic Index	8%	14%	23	14%	22
People of Color	24%	26%	64	39%	43
Low Income	19%	31%	34	31%	35
Unemployment Rate	4%	7%	50	6%	54
Limited English Speaking Households	1%	2%	76	5%	59
Less Than High School Education	3%	9%	26	12%	24
Under Age 5	6%	5%	65	6%	62
Over Age 64	15%	18%	43	17%	48
Low Life Expectancy	11%	20%	0	20%	1

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specifc individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one signifcant fgure and any additional signifcant fgures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 12
Water Dischargers 54
Air Pollution 46

Brownfields 1
Toxic Release Inventory 49

Other community features within defined area:

Schools 6
Hospitals 2
Places of Worship 8

Other environmental data:

Air Non-attainment ..... Yes
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 3 miles Ring Centered at 42.885241,-85.530496

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	11%	20%	0	20%	1
Heart Disease	4.8	6.6	12	6.1	24
Asthma	9.9	11.6	9	10	52
Cancer	6.2	6.6	36	6.1	50
Persons with Disabilities	8.8%	14.6%	15	13.4%	23

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	9%	7%	77	12%	62
Wildfire Risk	0%	0%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	8%	14%	35	14%	39
Lack of Health Insurance	4%	5%	35	9%	24
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	No	N/A	N/A	N/A	N/A

Footnotes

Report for 3 miles Ring Centered at 42.885241,-85.530496

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Lansing, MI

3 miles Ring Centered at 42.774976,- .589341
Population: 36,944
Area in square miles: 2 . 7

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	86%
Spanish	4%
French, Haitian, or Cajun	1%
German or other West Germanic	1%
Russian, Polish, or Other Slavic	1%
Other Indo-European	1%
Other Asian and Pacific Island	1%
Arabic	1%
Other and Unspecified	4%
Total Non-English	14%

COMMUNITY INFORMATION

- Low income: 36 percent
- People of color: 37 percent
- Less than high school education: 8 percent
- Limited English households: 2 percent
- Unemployment: 7 percent
- Persons with disabilities: 17 percent
- Male: 50 percent
- Female: 50 percent
- 75 years — Average life expectancy
- $29,467 — Per capita income
- Number of households: 15,277
- Owner occupied: 65 percent

BREAKDOWN BY RACE

- White: 63%
- Black: 18%
- American Indian: 0%
- Asian: 3%
- Hawaiian/Paci c Islander: 0%
- Other race: 0%
- Two or more races: 6%
- Hispanic: 10%

BREAKDOWN BY AGE

From Ages 1 to 4	5%
From Ages 1 to 18	22%
From Ages 18 and up	78%
From Ages 65 and up	15%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	28%
Speak Other Indo-European Languages	18%
Speak Asian-Pacific Island Languages	42%
Speak Other Languages	13%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

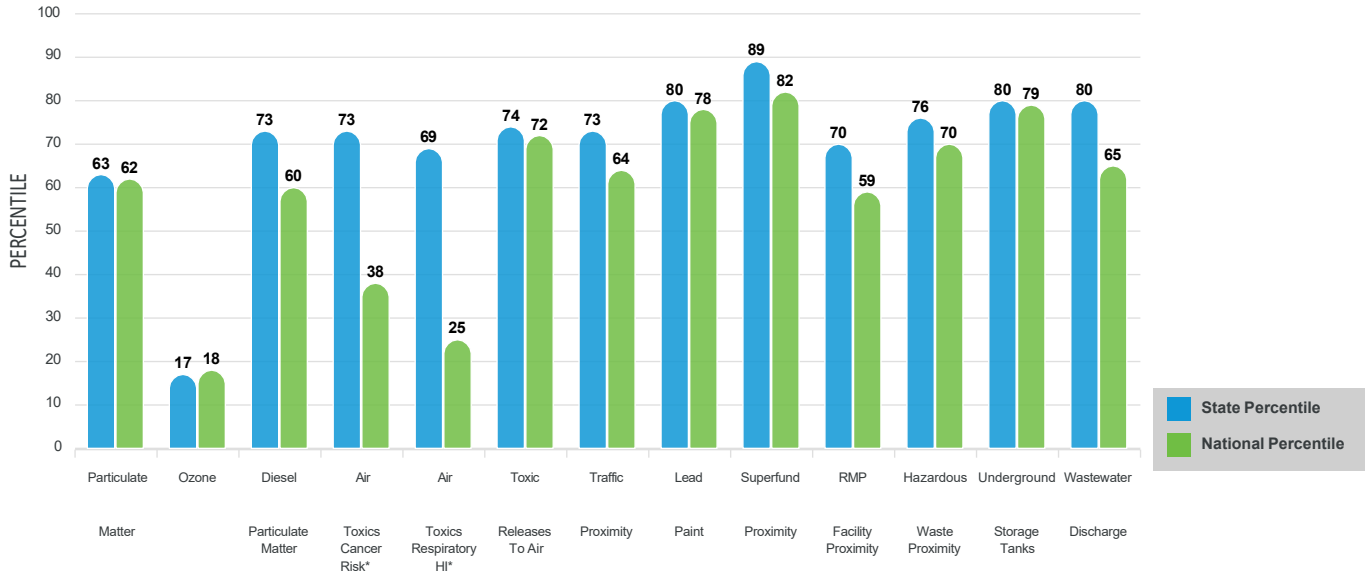
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen re ecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

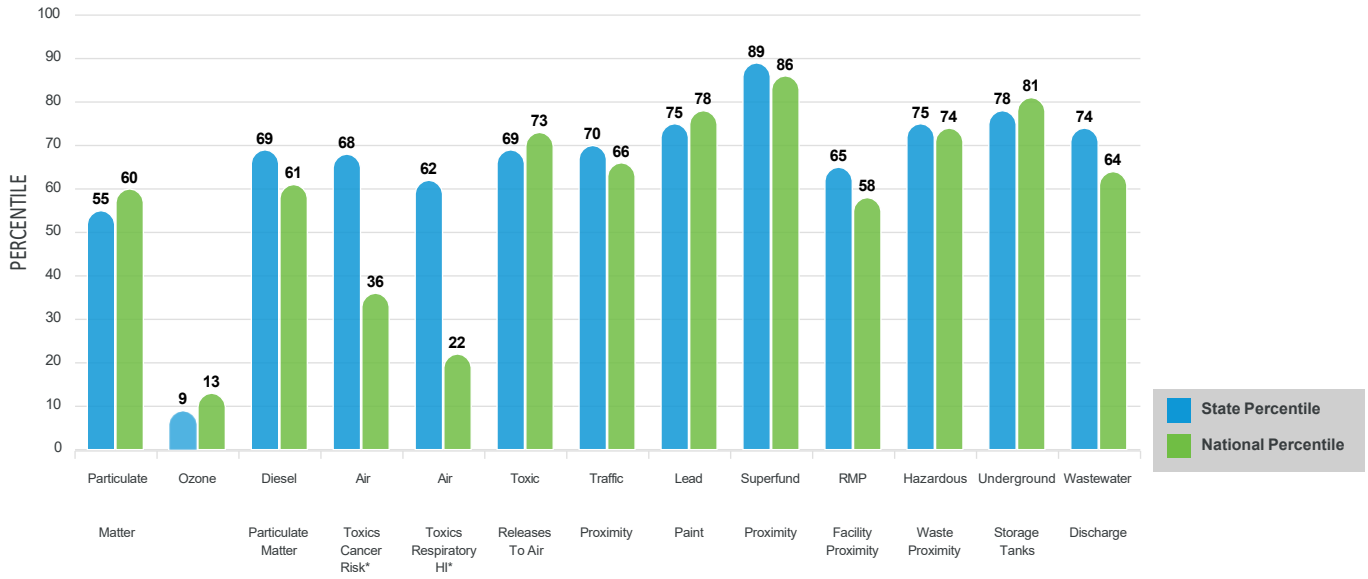
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community level vulnerability. They combine data on percent low income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 3 miles Ring Centered at 42.774976,-84.589341

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	8.11	8.51	35	8.08	47
Ozone (ppb)	55.1	60	6	61.6	9
Diesel Particulate Matter (µg/m^3)	0.196	0.183	56	0.261	44
Air Toxics Cancer Risk* (lifetime risk per million)	20	19	14	25	5
Air Toxics Respiratory HI*	0.2	0.2	11	0.31	4
Toxic Releases to Air	2,800	2,500	80	4,600	78
Traffic Proximity (daily traffic count/distance to road)	130	120	71	210	63
Lead Paint (% Pre-1960 Housing)	0.55	0.38	70	0.3	77
Superfund Proximity (site count/km distance)	0.71	0.15	96	0.13	96
RMP Facility Proximity (facility count/km distance)	0.18	0.31	60	0.43	52
Hazardous Waste Proximity (facility count/km distance)	1.5	1.1	73	1.9	68
Underground Storage Tanks (count/km^2)	21	8	88	3.9	96
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0027	0.13	72	22	57
SOCIOECONOMIC INDICATORS					
Demographic Index	37%	28%	74	35%	60
Supplemental Demographic Index	15%	14%	65	14%	61
People of Color	37%	26%	76	39%	56
Low Income	36%	31%	65	31%	64
Unemployment Rate	7%	7%	67	6%	70
Limited English Speaking Households	2%	2%	80	5%	62
Less Than High School Education	8%	9%	57	12%	49
Under Age 5	5%	5%	56	6%	53
Over Age 64	15%	18%	42	17%	46
Low Life Expectancy	21%	20%	63	20%	67

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 2
Hazardous Waste, Treatment, Storage, and Disposal Facilities 3
Water Dischargers 127

Air Pollution 15
Brownfields 30
Toxic Release Inventory 14

Other community features within defined area:

Schools 11
Hospitals 2
Places of Worship 29

Other environmental data:

Air Non-attainment ..... Yes
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 3 miles Ring Centered at 42.774976,-84.589341

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	21%	20%	63	20%	67
Heart Disease	6.1	6.6	35	6.1	50
Asthma	11.5	11.6	61	10	86
Cancer	5.8	6.6	24	6.1	39
Persons with Disabilities	16.4%	14.6%	65	13.4%	72

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	7%	7%	63	12%	52
Wildfire Risk	0%	0%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	14%	14%	57	14%	59
Lack of Health Insurance	5%	5%	48	9%	34
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

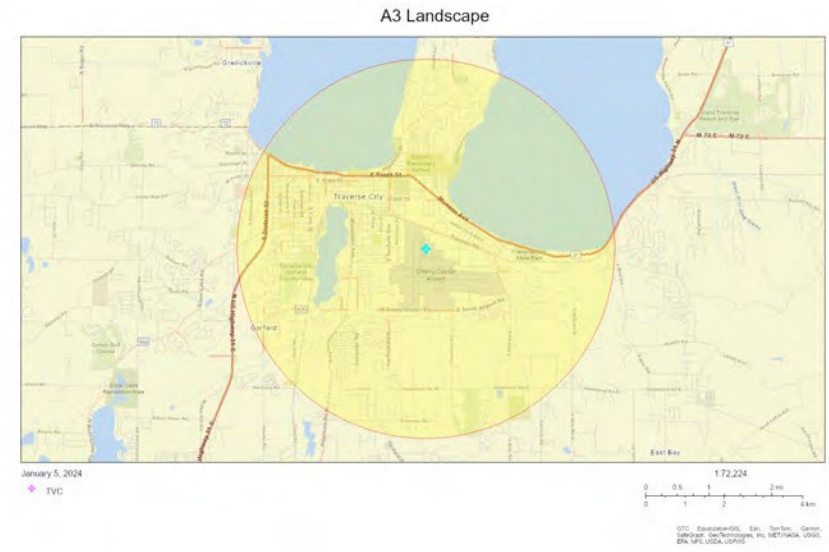
Report for 3 miles Ring Centered at 42.774976,-84.589341

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Traverse City, MI

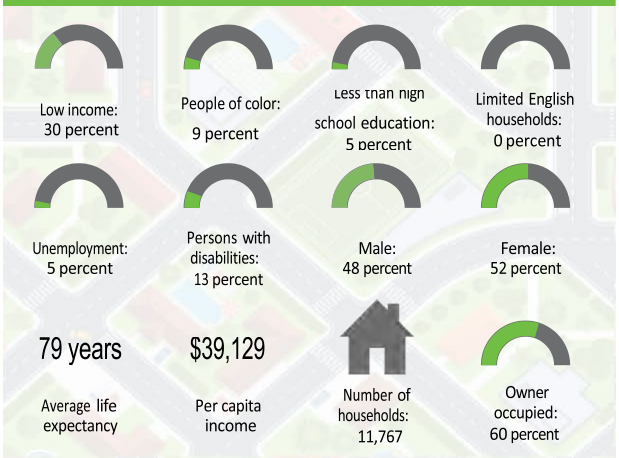
3 miles Ring Centered at 44.747381,-85.583534
Population: 25,466
Area in square miles: 2 . 7



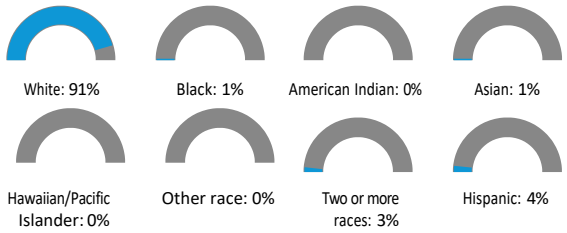
LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	97%
Spanish	2%
Russian, Polish, or Other Slavic	1%
Total Non-English	3%

COMMUNITY INFORMATION

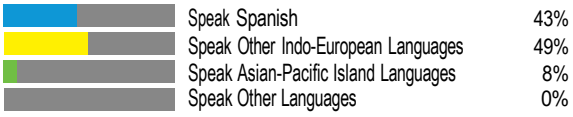


BREAKDOWN BY RACE



BREAKDOWN BY AGE

LIMITED ENGLISH SPEAKING BREAKDOWN



Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

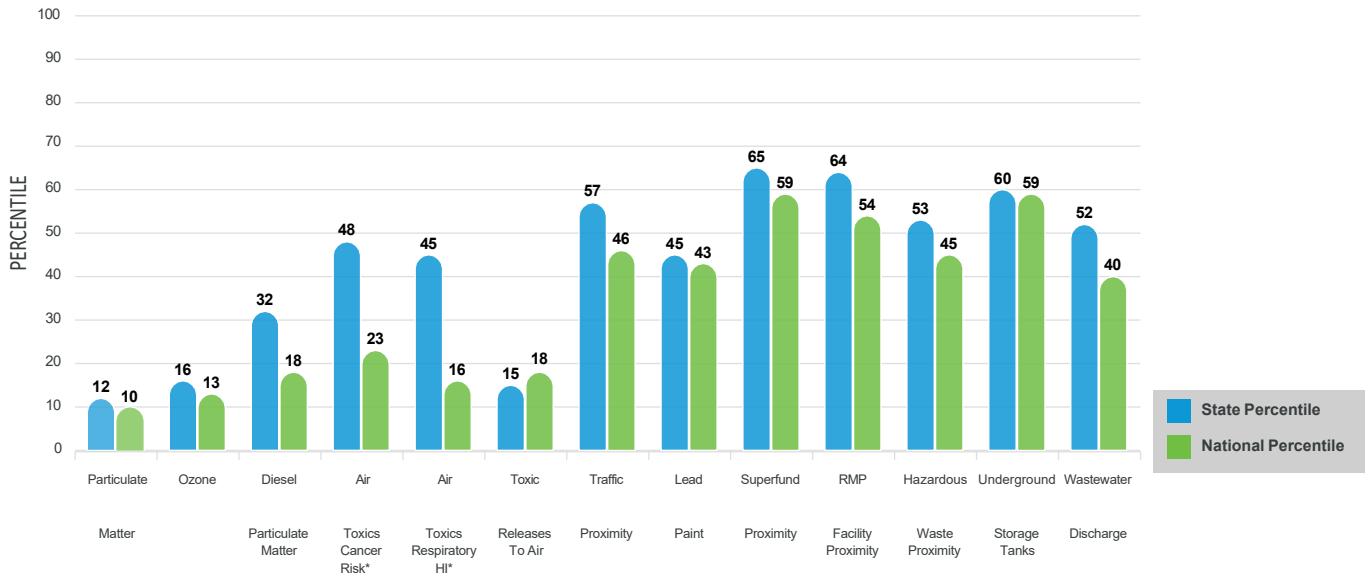
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen re ecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

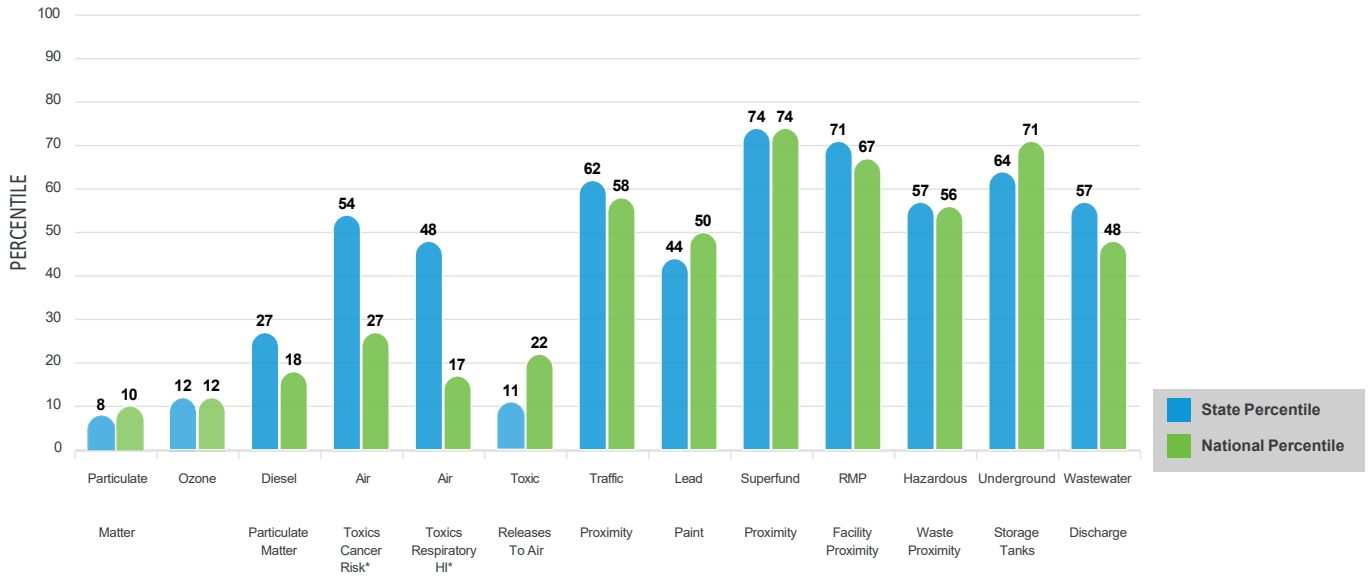
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community level vulnerability. They combine data on percent low income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 3 miles Ring Centered at 44.747381,-85.583534

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	6.05	8.51	8	8.08	8
Ozone (ppb)	55.7	60	11	61.6	11
Diesel Particulate Matter (µg/m^3)	0.0982	0.183	19	0.261	15
Air Toxics Cancer Risk* (lifetime risk per million)	19	19	0	25	1
Air Toxics Respiratory HI*	0.19	0.2	1	0.31	1
Toxic Releases to Air	100	2,500	11	4,600	24
Traffic Proximity (daily traffic count/distance to road)	120	120	69	210	62
Lead Paint (% Pre-1960 Housing)	0.33	0.38	51	0.3	60
Superfund Proximity (site count/km distance)	0.18	0.15	80	0.13	82
RMP Facility Proximity (facility count/km distance)	0.44	0.31	80	0.43	74
Hazardous Waste Proximity (facility count/km distance)	0.61	1.1	51	1.9	53
Underground Storage Tanks (count/km^2)	12	8	76	3.9	91
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0015	0.13	65	22	52
SOCIOECONOMIC INDICATORS					
Demographic Index	19%	28%	43	35%	31
Supplemental Demographic Index	12%	14%	48	14%	45
People of Color	9%	26%	36	39%	21
Low Income	30%	31%	55	31%	55
Unemployment Rate	5%	7%	52	6%	55
Limited English Speaking Households	0%	2%	73	5%	57
Less Than High School Education	5%	9%	40	12%	35
Under Age 5	5%	5%	50	6%	48
Over Age 64	23%	18%	75	17%	77
Low Life Expectancy	19%	20%	42	20%	50

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specifc individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one signifcant fgure and any additional signifcant fgures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund	0
Hazardous Waste, Treatment, Storage, and Disposal Facilities	2
Water Dischargers	19
Air Pollution	14
Brownfields	15
Toxic Release Inventory	14

Other community features within defined area:

Schools	14
Hospitals	7
Places of Worship	38

Other environmental data:

Air Non-attainment	No
Impaired Waters	Yes

Selected location contains American Indian Reservation Lands*	No
Selected location contains a "Justice40 (CEJST)" disadvantaged community	No
Selected location contains an EPA IRA disadvantaged community	Yes

Report for 3 miles Ring Centered at 44.747381,-85.583534

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	19%	20%	42	20%	50
Heart Disease	6.9	6.6	57	6.1	65
Asthma	10.7	11.6	28	10	71
Cancer	7.8	6.6	79	6.1	84
Persons with Disabilities	12.8%	14.6%	41	13.4%	52

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	12%	7%	86	12%	73
Wildfire Risk	0%	0%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	12%	14%	50	14%	53
Lack of Health Insurance	6%	5%	67	9%	46
Housing Burden	No	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

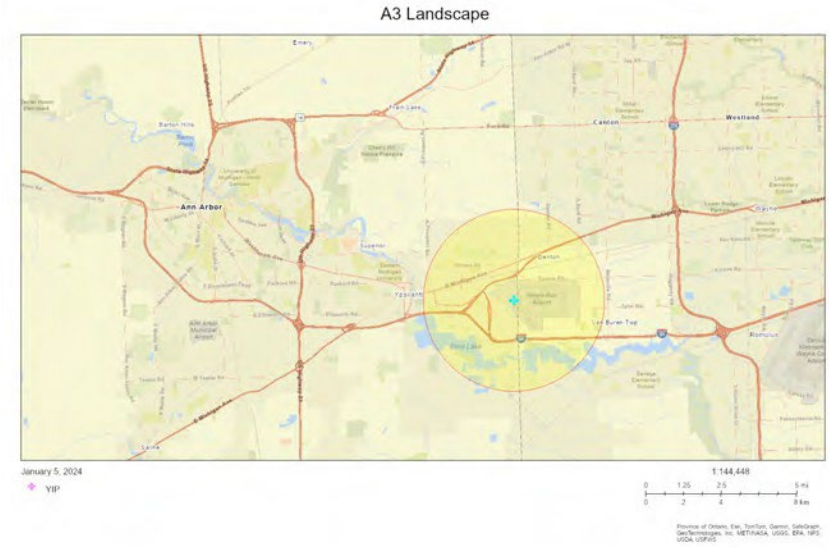
Report for 3 miles Ring Centered at 44.747381,-85.583534

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Washtenaw County, MI

3 miles Ring Centered at 42.237414,-83.546562
Population: 43,539
Area in square miles: 2 . 7



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	90%
Spanish	5%
Other Indo-European	1%
Chinese (including Mandarin, Cantonese)	1%
Other Asian and Pacific Island	1%
Arabic	1%
Total Non-English	10%

COMMUNITY INFORMATION

- Low income: 38 percent
- People of color: 49 percent
- Less than high school education: 12 percent
- Limited English households: 2 percent
- Unemployment: 9 percent
- Persons with disabilities: 17 percent
- Male: 49 percent
- Female: 51 percent
- 67 years — Average life expectancy
- $29,968 — Per capita income
- Number of households: 18,381
- Owner occupied: 57 percent

BREAKDOWN BY RACE

- White: 51%
- Black: 34%
- American Indian: 0%
- Asian: 1%
- Hawaiian/Pacific Islander: 0%
- Other race: 1%
- Two or more races: 7%
- Hispanic: 7%

BREAKDOWN BY AGE

From Ages 1 to 4	6%
From Ages 1 to 18	21%
From Ages 18 and up	79%
From Ages 65 and up	13%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	67%
Speak Other Indo-European Languages	12%
Speak Asian-Pacific Island Languages	13%
Speak Other Languages	8%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

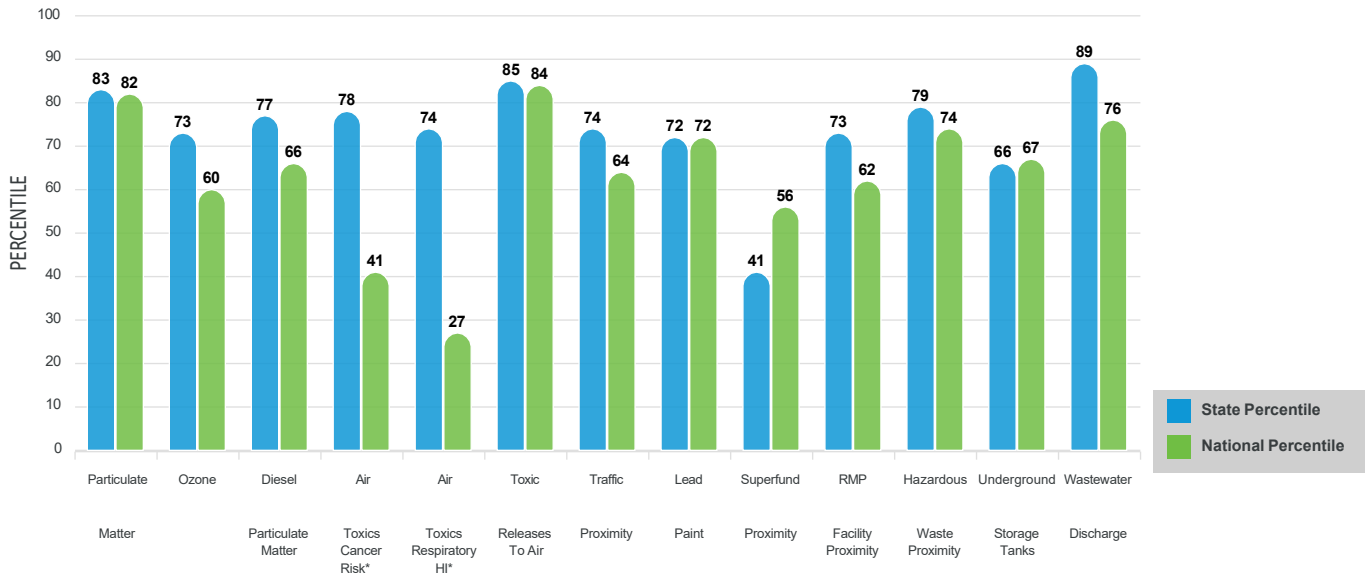
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen re ecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

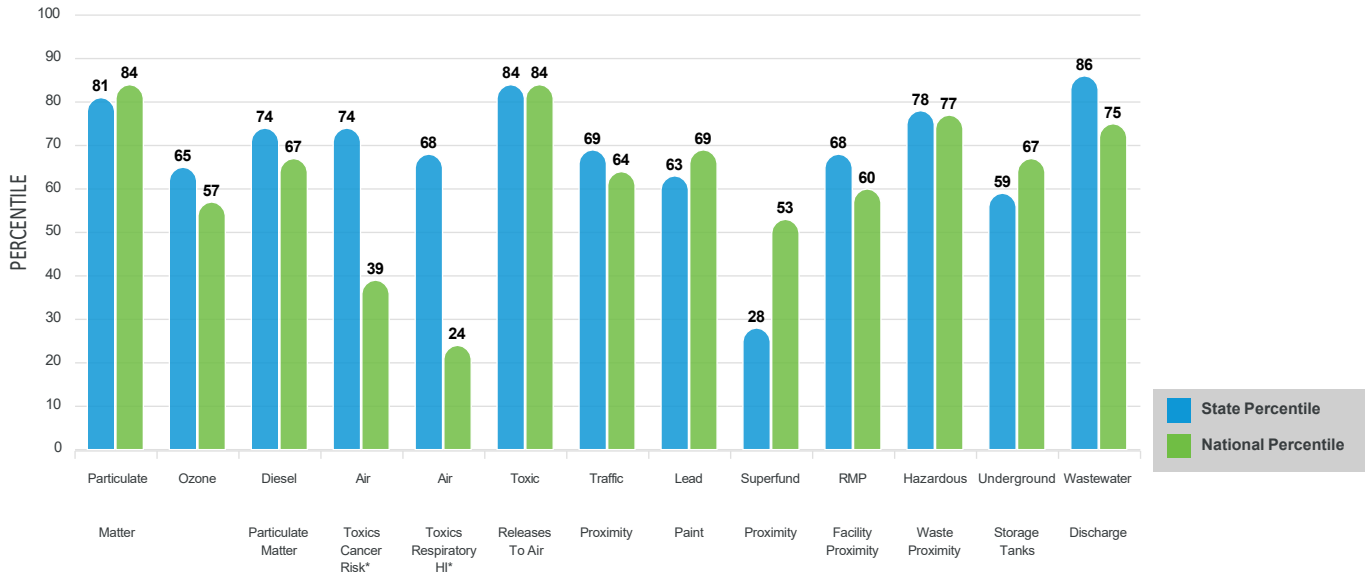
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community level vulnerability. They combine data on percent low income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for 3 miles Ring Centered at 42.237414,-83.546562

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (µg/m^3)	9.31	8.51	65	8.08	80
Ozone (ppb)	59.7	60	44	61.6	37
Diesel Particulate Matter (µg/m^3)	0.21	0.183	60	0.261	48
Air Toxics Cancer Risk* (lifetime risk per million)	20	19	14	25	5
Air Toxics Respiratory HI*	0.2	0.2	11	0.31	4
Toxic Releases to Air	11,000	2,500	96	4,600	93
Traffic Proximity (daily traffic count/distance to road)	120	120	69	210	61
Lead Paint (% Pre-1960 Housing)	0.33	0.38	51	0.3	60
Superfund Proximity (site count/km distance)	0.035	0.15	17	0.13	32
RMP Facility Proximity (facility count/km distance)	0.16	0.31	56	0.43	48
Hazardous Waste Proximity (facility count/km distance)	1.5	1.1	73	1.9	68
Underground Storage Tanks (count/km^2)	4.6	8	55	3.9	75
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.011	0.13	84	22	68
SOCIOECONOMIC INDICATORS					
Demographic Index	44%	28%	79	35%	68
Supplemental Demographic Index	17%	14%	73	14%	68
People of Color	49%	26%	82	39%	65
Low Income	38%	31%	67	31%	67
Unemployment Rate	9%	7%	73	6%	76
Limited English Speaking Households	2%	2%	81	5%	64
Less Than High School Education	12%	9%	72	12%	63
Under Age 5	6%	5%	61	6%	58
Over Age 64	13%	18%	36	17%	40
Low Life Expectancy	20%	20%	47	20%	54

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specifc individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one signifcant fgure and any additional signifcant fgures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 5
Water Dischargers 29
Air Pollution 10
Brownfields 13
Toxic Release Inventory 8

Other community features within defined area:

Schools 12
Hospitals 2
Places of Worship 31

Other environmental data:

Air Non-attainment ..... Yes
Impaired Waters ..... Yes

Selected location contains American Indian Reservation Lands* ..... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community ..... Yes
Selected location contains an EPA IRA disadvantaged community ..... Yes

Report for 3 miles Ring Centered at 42.237414,-83.546562

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	20%	20%	47	20%	54
Heart Disease	5.9	6.6	33	6.1	48
Asthma	13.5	11.6	85	10	97
Cancer	5.5	6.6	19	6.1	33
Persons with Disabilities	15.9%	14.6%	62	13.4%	70

CLIMATE INDICATORS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	9%	7%	77	12%	63
Wildfire Risk	0%	0%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	HEALTH VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	10%	14%	44	14%	47
Lack of Health Insurance	7%	5%	76	9%	54
Housing Burden	No	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Footnotes

Report for 3 miles Ring Centered at 42.237414,-83.546562

Attachment 2. Final Equity Analysis

Equity Analysis MDOT

Pollution Source	State Average	Gerald R. Ford International	Battle Creek Executive	Capitol Region International	Willow Run	Cherry Capital	Ann Arbor Municipal
Particulate Matter (µg/m3)	8.51	8.45	8.15	8.11	9.31	6.05	8.96
Ozone (ppb)	60	59.6	57.9	55.1	59.7	55.7	58.4
Diesel Particulate Matter (µg/m3)	0.183	0.185	0.164	0.196	0.21	0.0982	0.232
Air Toxics Cancer Risk (lifetime risk per million)	19	20	20	20	20	19	20
Air Toxics Respiratory	0.2	0.2	0.2	0.2	0.2	0.19	0.2
Toxic Released to Air	2,500	1500	8,800	2,800	11,000	100	660
Traffic Proximity (daily traffic count/distance to road)	120	73	66	130	120	120	150
Superfund Proximity (site count/km distance)	0.15	0.34	0.13	0.71	0.035	0.18	0.042
Hazardous Waste Proximity (facility count/km distance)	1.1	3.4	1.1	1.5	1.5	0.61	2.9
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.13	0.00011	0.0003	0.0027	0.011	0.0015	0.024

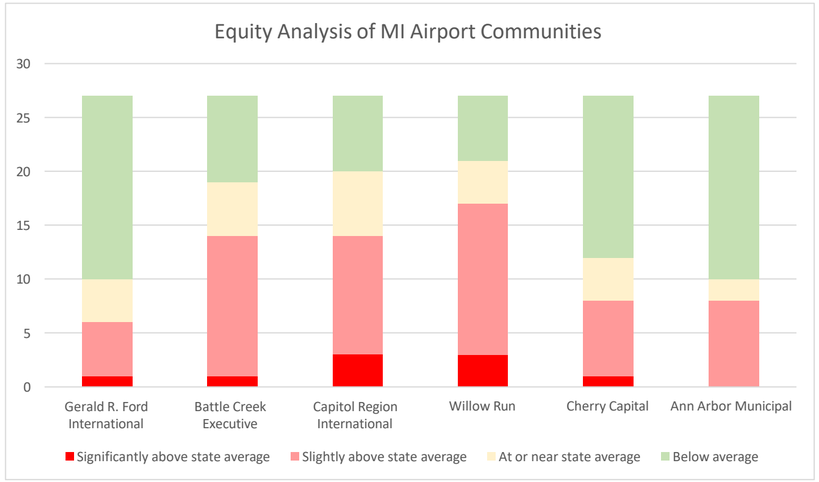
Socioeconomic Indicators	State Average	Gerald R. Ford International	Battle Creek Executive	Capitol Region International	Willow Run	Cherry Capital	Ann Arbor
Demographic Index	28%	21%	36%	37%	44%	19%	26%
Supplemental Demographic Index	14%	8%	18%	15%	17%	12%	10%
People of Color	26%	24%	32%	37%	49%	9%	30%
Low Income	31%	19%	40%	36%	38%	30%	22%
Unemployment Rate	7%	4%	7%	7%	9%	5%	3%
Limited English Speaking Households	2%	1%	4%	2%	2%	0%	5%
Less Than Highschool Education	9%	3%	12%	8%	12%	5%	3%
Under Age 5	5%	6%	6%	5%	6%	5%	5%
Over Age 64	18%	15%	14%	15%	13%	23%	16%

Health Indicators	State Average	Gerald R. Ford International	Battle Creek Executive	Capitol Region International	Willow Run	Cherry Capital	Ann Arbor
Low Life Expectancy	20%	11%	23%	21%	20%	19%	15%
Heart Disease	6.6	4.8	7.2	6.1	5.9	6.9	4.2
Asthma	11.6	9.9	11.8	11.5	13.5	10.7	11
Cancer	6.6	6.2	6.6	5.8	5.5	7.8	5.7
Persons with Disabilities	14.6%	8.80%	14.9%	16.40%	15.90%	12.8%	7.70%

Climate Indicators	State Average	Gerald R. Ford International	Battle Creek Executive	Capitol Region International	Willow Run	Cherry Capital	Ann Arbor
Flood Risk	7%	9%	6%	7%	9%	12%	4%

Critical Service Gaps	State Average	Gerald R. Ford International	Battle Creek Executive	Capitol Region International	Willow Run	Cherry Capital	Ann Arbor
Broadband Internet	14%	8%	16%	14%	10%	12%	5%
Lack of Health Insurance	5%	4%	5%	5%	7%	6%	2%

Key:	Significantly above state average	Slightly above state average	At or near state average	Below average
Gerald R. Ford International	1	5	4	17
Battle Creek Executive	1	13	5	8
Capitol Region International	3	11	6	7
Willow Run	3	14	4	6
Cherry Capital	1	7	4	15
Ann Arbor Municipal	0	8	2	17



Final Ranking

1. Ann Arbor
1. Gerald R. Ford
2. Cherry Capital
3. Battle Creek
4. Capitol Region
5. Willow Run

Appendix H:
Multimodal Charging Station Decision Matrix

Prepared by:

Michigan Department of Transportation
Multi-modal Charging Station Decision Matrix

Version Date: March 25, 2024

	Potential Airports:	ARB- Ann Arbor	BTL- Battle Creek	GRR- Gerald Ford	LAN- Capital Region	TVC- Cherry Capital	YIP- Willow Run	Scoring Justification	Reason for Scoring Importance	Comments on Ranking
Category 1:	Does airport currently have sufficient capacity to support increased electrical demand or short term ability to increase electrical capacity?	1	1	2	2	1	1	**Ranked either 0 or 1 or 2:** 0 = airport does not have excess electrical capacity and unable to increase capacity in the short term 1 = airport can increase electrical capacity in the short term (approximately 1-year) 2 = airport currently has enough electrical capacity to support a multi-modal charging station	Electrical capacity, along with connectivity and Environmental Justice, were the three main criteria. Without electrical capacity, the construction of the multimodal charging station would not be justifiable. A high (0-2) scoring rating was set up for this criteria.	Airports with known capacity to handle the estimated electrical demand to support a multi-modal charging facility were scored 2, while the airports with unknown capacity or can bring in short term capacity to handle a multi-modal charging station given 1, while airports without current capacity or short term solution scored 0.
Category 2:	Does the airport have network connectivity? (i.e., accessibility to AAM networks outside of Michigan)	2	1	1	2	1	2	**Ranked 0, 1, or 2:** 0 = the airport has virtually no connectivity to other states but connectivity within the state 1 = the airport has limited connectivity to other states 2 = the airport has efficient connectivity to other states See map *based on connectivity to route network within Ohio, Indiana, New York, Wisconsin, and Illinois*	Connectivity to other out of state airports with electric aircraft capabilities, along with electricity and Environmental Justice, were the three main criteria. Without connectivity to airports able to charge electric aircraft, the construction of the multimodal charging station would not be justifiable. A high (0-2) scoring rating was set up for this criteria.	See map. Airports with 250 miles range for connection to airports with electric airport charging given 2, airports with partial connection given 1, and airports with minimal out of state connection given 0.
Category 3:	Is the airport located in an Environmental Justice or Disadvantage Area that could benefit from economic development?	0	1.5	0.5	2	1	2	**Ranked 0, .5, 1, 1.5, or 2.** 0 - Lowest disadvantaged area rank 2- Highest disadvantaged area rank with other airports proportioned based on the equity analysis for a 3-mile radius from the airport.	The view is that the location of a multi-modal charging station may assist the growth in economics of an area. Therefore, environmental justice or being located in a disadvantaged area, along with electrical capacity and connectivity were the three main criteria. A high (0-2) scoring rating was set up for this criteria.	Rankings were based on the equity analysis performed in this research for a radius of 3-miles.
Category 4:	Does the airport have its own utility loop?	0	0	1	1	0.5	0	**Ranked either 0, 0.5 or 1:** 0= Airport does not have its own utility loop or electrical redundancy. O.5= Airport does not have a utility loop for redundancy but has two services that can provide power to the charging station 1=Airport does have its own utility loop for electrical redundancy.	An airport loop provides electrical redundancy, which is important in selection if the main source of power is interrupted. Not a main priority, but important in the selection compared to other criteria. A medium (0-1) scoring rating was set up for this criteria.	Airports with utility loop for redundancy to handle potential outages were scored 1, airports with redundancy of two or more services with capacity to handle the additional load were scored a 0.5, while the airports with limit or unknown capacity to handle a multi-modal charging station given 0.

	Potential Airports:	ARB- Ann Arbor	BTL- Battle Creek	GRR- Gerald Ford	LAN- Capital Region	TVC- Cherry Capital	YIP- Willow Run	Scoring Justification	Reason for Scoring Importance	Comments on Ranking
Category 5:	Does the airport have an ARFF?	0.5	0.5	1	1	1	1	**Ranked either 0 or 0.5 or 1:** 0 = Airport does not have ARFF or nearby fire fighting operations 0.5 = airport does not have an ARFF but has nearby fire fighting operations 1 = airport has an ARFF	The need for fire fighting capabilities was deemed important due to potential of battery fires during charging. Although not experienced by aircraft, this has been a topic of frequent discussion regarding charging of vehicles, especially in garages. A medium (0-1) scoring rating was set up for this criteria.	Airports with an ARFF on site given the highest ranking of a 1.0, while a nearby fire station given medium ranking given a 0.5.
Category 6:	How can weather affect the use of electric aircraft?	0.5	0.5	0.5	0.5	0	0.5	**Ranked either 0 or 0.5:** 0= Airport Locations north of the north boundary of Township 20 0.5 = Airport Locations south of the north boundary of Township 20.	In speaking with aircraft manufacturers, they stressed the importance of weather in selecting the initial sites for electric aircraft. They suggested the south and east of Michigan provides better weather for electric aircraft. A minimal scoring rating was set up for this criteria.	To determine affect of weather, C&S used the seasonal limitations for permanent seeding. which is divided at the north boundary of Township 20. i. Southern Lower Peninsula - South of the north boundary of Township 20, given a 0.5 ii. Northern Lower Peninsula - North of the north boundary of Township 20, given a 0
Category 7:	Does airport property have any known environmental concerns?	0	0	0	0	0	0	**Ranked either 0 or 0 .5:** 0= airports with known environmental concerns 0.5= airports with no known environmental concerns	Environmental concerns could limit development due to potential contamination or a significant environmental concern. A minimal scoring rating was set up for this criteria.	Properties with environmental concerns were assigned 0 points, while airports with no environmental concern assigned 0.5.
Category 8:	Are sustainable power sources being used currently? (i.e. solar)	0.5	0	0.5	0	0	0	**Ranked either 0 or 0.5:** 0= Airport does not currently have alternative energy sources 0.5= Airport does have alternative energy sources	The existing use of sustainable power sources was viewed as a positive to assist in the electrical needs of the multimodal station, reducing demand from the grid. A minimal scoring rating was set up for this criteria.	Airports with sustainable power was scored with 0.5 points, while airports with no sustainable power scored a 0.
Category 9:	Is the airport pursuing funding opportunities?	0.5	0.5	0.5	0.5	0.5	0	**Ranked either 0 or 0.5 :** 0 = airport is not pursuing funding opportunities 0.5 = airport is looking into funding opportunities	The pursuit of other funding sources besides MDOT was viewed as important in assisting to offset the costs of a multi-modal facility. A minimal scoring rating was set up for this criteria.	Airports pursuing funding were give 0.5 points, while airports not actively pursuing funding given a zero.
Category 10:	Has the airport connected with AAM companies?	0.5	0	0.5	0.5	0.5	0.5	**Ranked either 0 or .5:** 0= airport has not connected with AAM companies 0.5= airport has connected with AAM companies	The connection with an existing AAM company was important, as these airports would likely be the first to have electric aircraft. A minimal scoring rating was set up for this criteria.	Airports pursuing AAM given 0.5 points while others given 0.0
Category 11:	Is the airport handling cargo?	0	0.5	0.5	0.5	0.5	0.5	**Ranked either 0 or 0.5:** 0 = the airport does not handle cargo	The handling of cargo was deemed important as electric aircraft are expected to transport cargo before transporting passengers. A minimal scoring	Airports that currently handle cargo were given a 0.5, while airports that do

	Potential Airports:	ARB- Ann Arbor	BTL- Battle Creek	GRR- Gerald Ford	LAN- Capital Region	TVC- Cherry Capital	YIP- Willow Run	Scoring Justification	Reason for Scoring Importance	Comments on Ranking
Category 12:	Does the airport offer amenities? (i.e., rental car services, restrooms, food/beverages)	0.5	0.5	0.5	0.5	0.5	0.5	**Ranked either 0 or 0.5:** 0 = the airport does not offer amenities 0.5 = the airport does offer amenities	Amenities were considered important to offer those driving electric vehicles and using electric aircraft services. A minimal scoring rating was set up for this criteria.	The airports that offer amenities were given a 0.5, while airports with no amenities given a 0.0.
Category 13:	Does the airport have sufficient runway length?	0	0.5	0.5	0.5	0.5	0.5	**Ranked either 0 or 0.5**: 0= Does not have runway with a length of at least 3,800 feet 0 .5= Has runway with a length of at least 3,800 feet	A runway length of 3,800 feet was deemed important if backup fuel powered aircraft was used. A minimal scoring rating was set up for this criteria.	Airports with runway length of less than 3,800 feet given a 0.0, while airports with runway length of greater than 3,800 feet given a 0.5.
Total (all categories):		**6**	**6.5**	**9**	**11**	**7**	**8.5**			

Additional items considered as criteria, determined to have no effect on the selection:
Current EV Charging
Public Transportation
Economic cost variation between locations

Legend:

High Scoring Rating
Medium Scoring Rating
Minimal Scoring Rating

Appendix I:
Final Recommendation Memorandum

C&S Engineers, Inc.
38777 Six Mile Rd. Suite 202
Livonia, MI 48152

Michigan Department of Transportation Multimodal Aircraft Charging Station Deployment—Phase 1

Airport Final Selection Narrative

April 2024

MDOT
Michigan Department of Transportation

Introduction

The C&S team (C&S Engineers and HoveCon) conducted a comprehensive process to select one or two Michigan airports for the recommended deployment of multimodal electric charging station. The final airport selection is the culmination of a phased research process to assess and rank airports within the State of Michigan with publicly available data, a survey of airports, site-visits to assess current infrastructure and the desire expressed by airport staff to host a multimodal charging system. This multi-step process involved the evaluation of various relevant variables to determine which airports are best positioned at this time to excel in the emerging markets of advanced air mobility (AAM) and regional air mobility (RAM) for integrating electrification in transportation and aviation, encompassing both cargo and passenger movement.

This Final Selection Narrative summarizes the methodology, the 13 scoring categories, how airports were scored and the final airport recommendation to the Michigan Department of Transportation (MDOT). It should be noted that the methodology, scoring categories, and scoring were discussed with MDOT throughout the process.

Methodology

Based on the Airport Short List Selection Narrative report dated October 2023, six airports were chosen as potential airports for potentially being the location for a multimodal electric charging station. These short-listed airports included the following:

Table 1. Airport Shortlist

Airport	Airport Code	Airport Type
Cherry Capital Airport	TVC	Primary – Non-Hub
Gerald R. Ford International Airport	GRR	Primary – Small-Hub
Capital Region International Airport	LAN	Primary – Non-Hub
Battle Creek Executive Airport at Kellogg Field	BTL	General Aviation
Ann Arbor Municipal Airport	ARB	General Aviation
Willow Run Airport	YIP	General Aviation

The C&S team undertook the task of selecting key variables critical to gauge each of the six shortlist airports (reflected in Table 1) for readiness for multimodal electrification. A detailed overview of each variable and the selection criteria applied is provided in the attached Michigan Department of Transportation Multi-modal Charging Station Decision Excel Matrix spreadsheet (Appendix A). The airports were assessed and ranked to select the recommended airport(s) for an initial multimodal charging station. Evaluation scoring was determined through the following:

- Initial Survey of Airports as detailed in a comprehensive assessment process identified in the C&S Memo dated July 27, 2023
- Site visits to each airport and meetings with applicable personnel to assess current infrastructure and airport desire to host a multi-modal charging system.
- Research into connectivity, social equity, weather impacts, and potential environmental concerns.
- Recommendations from AAM operators and manufacturers
- Airport feedback on initial scoring
- Scoring system weighting

Initial Survey of Airports

The initial survey of Michigan airports and the selection of the short-listed airports are summarized in the Airport Short List Selection Narrative report dated October 2023.

Airport Site Visits

The C&S team conducted site-visits of the six short-listed airports in November 2023 to obtain information on airport existing conditions and a site analysis of several airport attributes including existing electrical capacity, site features and drawbacks, and information on airport coordination with AAM manufacturers.

Research into Connectivity, Social Equity, Weather Impacts, and Potential Environmental Concerns

Electric aircraft operation will require a network of charging stations to facilitate both AAM and RAM operations moving passengers and cargo. The C&S team conducted research into the expected connectivity of each of the short-list airports and developed a map reflecting a 250 nautical mile (nmi) radius around each airport (Appendix B). Initially, AAM and RAM aircraft are expected to travel approximately 250nmi on a single battery charge. The map developed reflects connectivity to existing electric aircraft charging stations within a 250 nmi radius. This includes existing electric aircraft charging stations (as-of March 2023) Chataqua County Jamestown Airport, Akron-Canton Airport, and Springfield-Beckley Airport reflected in red, and future electric aircraft charging stations at Oshkosh Airport, Chicago O'Hare International Airport, and Dayton International Airport reflected in white.

In determining the optimal location for the forthcoming multimodal airport charging station, it is crucial to employ an environmental equity lens during the project planning phase. The C&S team completed an equity screening for this Project by cross referencing granular data from the EPA's Environmental Justice (EJ) Screening and Mapping Tool (EJ Screen) and additional screenshots from MiEJScreen, an interactive screening tool that identifies Michigan communities that may be disproportionately impacted by environmental hazards. The equity screening was conducted for the 3-mile radius around each of the six shortlisted airports and included data for various pollution sources, critical service gaps, and climate, health, and socioeconomic indicators.

To determine potential weather impacts on the selection of a final recommended airport, the C&S team used the seasonal limitations for permanent seeding. The seasonal limitations are used for airport design and uses the north boundary of Township 20. Airports in the Southern Lower Peninsula, South of the north boundary of Township 20, have traditionally had better weather to support electric aircraft than the northern airports were given a score of 0. Airports in the Northern Lower Peninsula, North of the north boundary of Township 20, were given a score of 0.5.

Environmental concerns are significant in the selection of a location for a multimodal charging station. Known environmental concerns could result in delays or impacts on development due to potential contamination or a significant environmental concern. To determine known environmental concerns the project team completed a screen utilizing the following environmental mapping tools:

- U.S. Fish & Wildlife Service, The National Wetlands Inventory (NWI) - utilized for a review of wetlands or other waters of the U.S. on airport property.
- Michigan EGLE Environmental Assistance Center Coastal Zone Boundary Maps - utilized for a review of each airport in relation to a given coastal zone.
- USEPA NEPAssist Mapper - utilized for a review of toxic releases (TRI), superfund sites (NPL), brownfields (ACRES), surface waters, floodplains, and historic places.
- U.S. Fish & Wildlife Service, Information, Planning, and Conservation (IPaC) System– The United States Fish and Wildlife Service (USFWS) utilizes the Information, Planning and Conservation (IPaC) system as a tool for streamlining the environmental review process. The IPaC system provides a species list that identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat that may occur within the boundary of the study area and/or may be affected by the proposed project.

As environmental concerns were identified at all airports, once a preferred site(s) is selected for the MDOT project, further NEPA review criteria should be evaluated to plan to address known environmental concerns in site selection.

Recommendations from AAM Operators and Manufacturers

The project team polled various AAM operators and manufacturers to better understand their preferences for AAM operation in Michigan and its bordering states. The following AAM operators and manufacturers were contacted as part of this survey (listed alphabetically):

- Archer Aviation, Inc.
- Beta Technologies
- Bristow
- Eve Air Mobility
- Ferrovial
- Joby Aviation
- Skyports
- Supernal
- Volatus Infrastructure
- UPS Flight Forward

AAM operator and manufacturer preferences were not directly utilized to select the final airport recommendation however, final recommendations from the full Excel Matrix were reviewed against AAM operator and manufacturer preferences to ensure general alignment with the industry. **Table 2**

reflects AAM respondent feedback on the question to, "Please rank your top three Michigan airports from this short-list. If it were up to your organization, which airports would receive preference for chargers?"

Table 2. AAM Operator and Manufacturer Top Three Shortlist Airports

Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Respondent 6	Respondent 7
Not Provided	Not Provided	ARB	YIP	LAN	GRR	LAN
		BTL	ARB	TVC	ARB	YIP
		TVC	LAN		LAN	BTL

Airport Feedback on Scoring

To ensure the initial scoring for each airport reflected in the MDOT Multi-modal Charging Station Decision Excel Matrix was accurate, the C&S team shared scoring results with the shortlist airports. Airport representatives were provided with the opportunity to review their scores for each of the 13 categories and to provide feedback and additional data as needed to request an adjustment to their score.

Weighting

Michigan Department of Transportation Multi-modal Charging Station Decision Excel Matrix criteria were weighted through the following methodology:

- High Scoring Rating - Critical criteria, such as electrical capacity, connectivity, and Environmental Justice/Disadvantaged Area equity. High scoring rating criteria allow for a score of up to 2 points and highlighted in Yellow.
- Medium Scoring Rating – Criteria that would be beneficial for selection, such as firefighting capabilities and electrical redundancy. Medium scoring rating criteria allow for a score up to 1 point and are highlighted in Green.
- Minimal Scoring Rating – Criteria that should be considered in the selection process. Minimal scoring rating criteria allow for a score up to 0.5 point and are highlighted in Orange.

Variables were weighted based on their significance in the AAM and RAM markets. Each airport was ranked individually, with higher scores indicating a stronger potential to excel in these markets. Every airport's ranking is also considered region-specific with regard to economic and demographic factors. This approach accounted for regional disparities and opportunities, enhancing the representativeness of our assessment regarding each airport's potential in the AAM and RAM markets.

Conclusion

The resulting Michigan Department of Transportation Multi-modal Charging Station Decision Excel Matrix (**Appendix A**) includes 13 categories and assesses the six short-listed airports quantitatively in each category. Variables were chosen to encompass a wide range of factors, including, but not limited to, available infrastructure at airports to support eVTOL transient aircraft, based aircraft, accessibility to the population center, and demographic data, ensuring a comprehensive assessment.

Based on the methodology provided above and the resulting Michigan Department of Transportation Multi-modal Charging Station Decision Excel Matrix spreadsheet (**Appendix A**), Lansing Capital Region International Airport (LAN) is recommended as the airport for continue further study and development of the preliminary design and implementation plan for a multimodal charging station.

LAN was the highest ranked airport for the deployment of an Airport Multi-modal Charging Station with a score of 11 out of a maximum of 12, with Gerald R. Ford International Airport in Grand Rapids (GRR) scoring a 9 and Willow Run Airport in Ypsilanti (YIP) scoring a total of 8.5. The remaining three airports scored between 6 and 7. It is believed that LAN has the power capacity, is in an area with access to other airports that are destinations for electric aircraft and has placed a considerable focus for electric aircraft charging a multi-modal charging station and the emerging markets of AAM and RAM.

APPENDIX A- Michigan Department of Transportation Multi-modal Charging Station Decision Excel Matrix

APPENDIX B- MDOT Multimodal Charging 250 Nautical Mile Radius Connectivity Map

Appendix J:
Multimodal Charging Station Concept Plan

Switchboard: M-EV

Location:
Supply From:
Mounting: RACK MOUNTED
Enclosure: TYPE 3R

Volts: 480/277 Wye
Phases: 3
Wires: 4

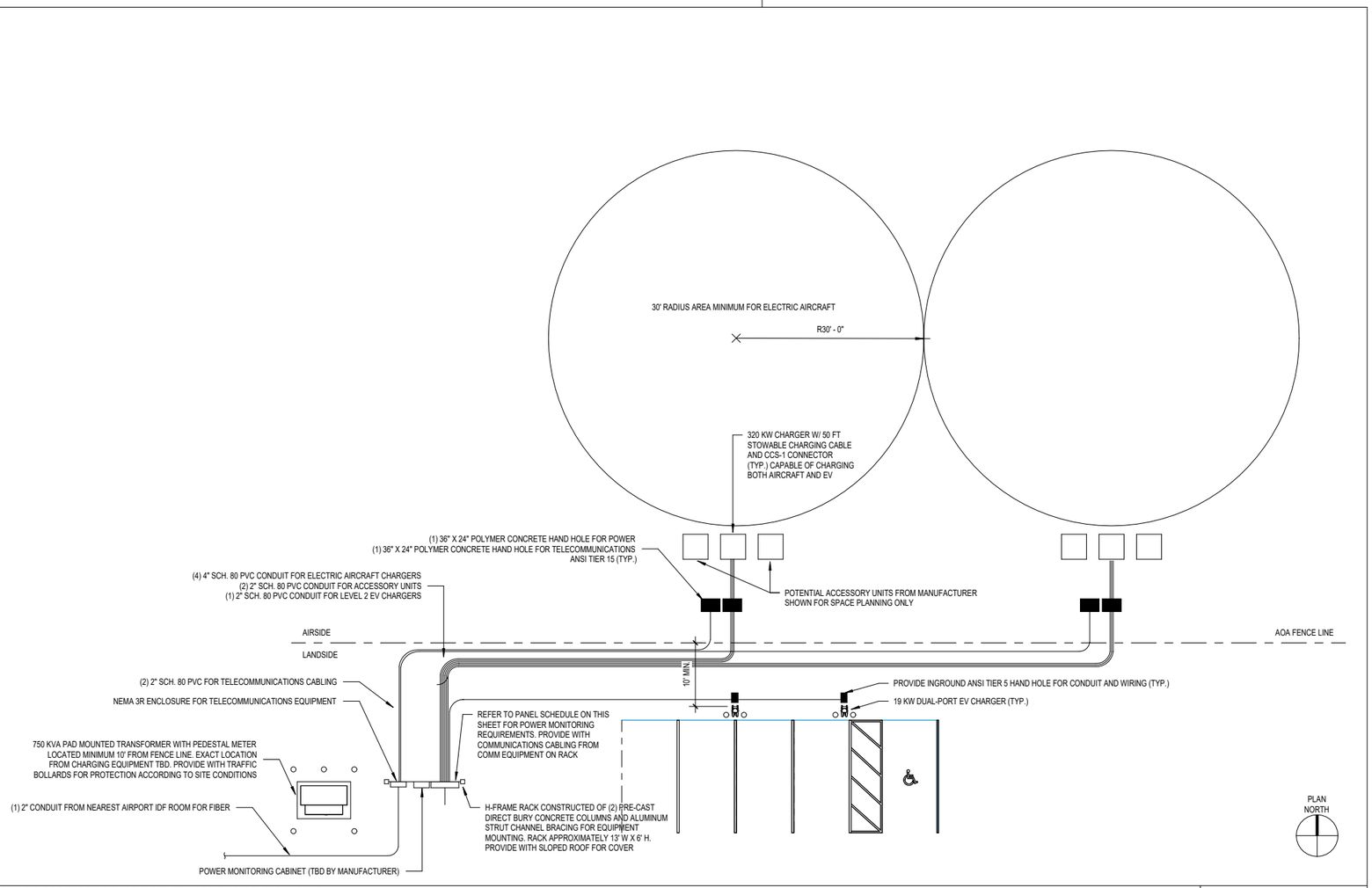
A.I.C. Rating: Coordinate w/ Utility
Mains Type: MCB
Mains Rating: 1200 A
MCB Rating: 1000 A

Notes:
SERVICE ENTRANCE RATED; EACH BRANCH CIRCUIT SHALL BE PROVIDED WITH DEDICATED POWER MONITORING DEVICE. POWER MONITORING DEVICES SHALL BE NETWORK CAPABLE AND RATED FOR USE IN AN OUTDOOR PANEL.

CKT	Circuit Description	# of Poles	Rating	Wire Size	Load	Remarks
1	ELECTRIC AIRCRAFT CHARGER	3	500 A	2 runs of 3-#500, 1-#500, 1-#1/0	320000 VA	Provide with power monitoring
2	ELECTRIC AIRCRAFT CHARGER	3	500 A	2 runs of 3-#500, 1-#500, 1-#1/0	320000 VA	Provide with power monitoring
3	LEVEL 2 EV CHARGER	3	30 A	3-#8, 1-#8, 1-#8	19000 VA	Provide with power monitoring
4	LEVEL 2 EV CHARGER	3	30 A	3-#8, 1-#8, 1-#8	19000 VA	Provide with power monitoring
5						
6						
7						
8						
				Total Conn. Load:	675124 VA	
				Total Amps:	812 A	

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Power	38000 VA	100.00%	38000 VA		
Spare	640000 VA	100.00%	640000 VA	**Total Conn. Load:**	675124 VA
				Total Est. Demand:	675124 VA
				Total Conn. Current:	812 A
				Total Est. Demand Current:	812 A



A1 MULTI-MODAL CONCEPT ELECTRICAL LAYOUT
SCALE: 3/32" = 1'-0"

0 5' 10' 20'

C&S COMPANIES®
C&S Engineers, Inc.
38777 Six Mile Road, Suite 202
Livonia, Michigan 48512
Phone: 734-953-2571
Fax: 734-206-7973
www.cscos.com

PRELIMINARY NOT FOR CONSTRUCTION

MDOT Michigan Department of Transportation

MULTIMODAL AIRPORT CHARGING STATION DEPLOYMENT MICHIGAN DEPARTMENT OF TRANSPORTATION

MARK	DATE	DESCRIPTION

REVISIONS

PROJECT NO:	722005001
DATE:	05/31/2024
DRAWN BY:	M. LARUE, PE
DESIGNED BY:	M. LARUE, PE
CHECKED BY:	J. TRENDOWSKI

CONTRACTOR SHALL VERIFY ALL CONDITIONS ON JOB SITE & NOTIFY THE OWNER OF ANY VARIATIONS FROM DIMENSIONS SHOWN ON THESE DRAWINGS BEFORE PROCEEDING WITH ANY CONSTRUCTION.

MULTI-MODAL CHARGING STATION POWER PLAN

E-101

Appendix K:
Opinion of Probable Construction Costs

PROBABLE CONSTRUCTION COST - CONCEPT PLAN

MICHIGAN DEPARTMENT OF TRANSPORTATION — 722.005.001
MULTI-MODAL AIRPORT CHARGING STATION DEPLOYMENT — 05/30/24

TRADE: ELECTRICAL

ITEM NO	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	TOTAL
	Divisions 26				
1	FEEDER: 3" SCH. 80 PVC CONDUIT (ASSUMED 50 FT FEEDER x QTY OF CONDUIT)	200.00	LF	$30.00	$6,000.00
2	FEEDER: 300 KCMIL THHN/THWN-2	800.00	LF	$20.00	$16,000.00
3	1200A RATED DISTRIBUTION PANEL, W/ 1000A MCB NEMA 3R	1.00	EA	$20,000.00	$20,000.00
4	500A/3P BREAKER (480V)	2.00	EA	$8,000.00	$16,000.00
5	30A/3P BREAKER (480V)	2.00	EA	$2,000.00	$4,000.00
6	BRANCH CIRCUIT MONITORING EQUIPMENT	4.00	EA	$2,500.00	$10,000.00
7	500 KCMIL THHN/THWN-2	1880.00	LF	$27.00	$50,760.00
8	#1/0 AWG THHN/THWN-2	470.00	LF	$9.00	$4,230.00
9	4" SCH. 80 PVC CONDUIT	470.00	LF	$40.00	$18,800.00
10	2" SCH. 80 PVC CONDUIT	255.00	LF	$20.00	$5,100.00
11	LEVEL 3 AIRCRAFT CHARGER	2.00	EA	$250,000.00	$500,000.00
12	LEVEL 2 EV CHARGER	2.00	EA	$10,000.00	$20,000.00
13	750 KVA PAD MOUNTED UTILITY XFMR	1.00	ALLOW	$100,000.00	$100,000.00
14	COMMUNICATIONS CABLING	400.00	LF	$50.00	$20,000.00
15	COMMUNICATIONS EQUIPMENT	1.00	ALLOW	$15,000.00	$15,000.00
16	BOLLARDS	8.00	EA	$400.00	$3,200.00
17	TRENCHING	300.00	LF	$25.00	$7,500.00
18	HAND HOLES	6.00	EA	$900.00	$5,400.00
				SUBTOTAL	$821,990.00
				LOCATION MULTIPLE (1.04)	$854,869.60
				CONTINGENCY (15%)	$128,230.44
				OVERHEAD & PROFIT (10%)	$98,310.00
	ESTIMATED PROBABLE COST (EXCLUDING ACCESSORY UNITS FOR CHARGING, PERMITTING AND IMPACT FEES)				**$1,081,410.04**

This page has been intentionally left blank.