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Traffic Data Collection
VanDyke Horn
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VOLUME 1 – FINAL TECHNICAL REPORT

AIRPORT MASTER PLAN UPDATE

DETROIT METROPOLITAN WAYNE COUNTY AIRPORT

Prepared for

Wayne County Airport Authority
Detroit, Michigan

July 2017

DETROIT METRO • WILLOW RUN
WAYNE COUNTY AIRPORT AUTHORITY

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Volume 1 – Final Technical Report

Volume 2 – Final Technical Report Appendices

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Chapter 1
STRATEGIC VISION, GOALS, AND OBJECTIVES

This Master Plan Update for Detroit Metropolitan Wayne County Airport (the Airport) was prepared for the Wayne County Airport Authority (the Authority) between 2015 to 2017 by LeighFisher, in association with HNTB, Advanced Geomatics, C&S Engineers, Connico, CTI and Associates, Faith Group, Mead & Hunt, SmithGroup JJR, Synergy Consultants, Traffic Data Collection, VanDyke Horn, and Woolpert. This update identifies facility improvements that will enable the Airport to meet demand through 2035 and was prepared in accordance with Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5070-6B, Airport Master Plans and other FAA design standards and planning criteria.

This technical report is organized as follows:

- Chapter 1: Strategic Vision, Goals, and Objectives
- Chapter 2: Wayne County Airport Authority System Plan
- Chapter 3: Aviation Activity Forecast
- Chapter 4: Assessment of Existing Conditions
- Chapter 5: Facility Requirements
- Chapter 6: Alternatives Development and Evaluation
- Chapter 7: Facilities Implementation Plan
- Chapter 8: Financial Plan

- *Appendix A: Regression Analysis*
- *Appendix B: Detroit Region Air Cargo Forecasts*
- *Appendix C: Runway Protection Zone Inventory*
- *Appendix D: 2011 Traffic Counts*
- *Appendix E: Curbside and Ground Transportation Level of Service Analysis*
- *Appendix F: Flight Schedules*
- *Appendix G: Recommended Development Plan Cost Estimates*
- *Appendix H: Airport Recycling, Reuse, and Waste Reduction Plan*

The Authority owns and operates both the Detroit Metropolitan Wayne County and Willow Run airports. Detailed descriptions of the airport setting and site for each airport can be found in Chapter 2.

1.1 STRATEGIC VISION

The Authority conducted several workshops among senior Airport executives with assistance from the consultant team to establish a vision that was intended to provide the Airport with a plan that is safe, efficient, implementable, flexible, and fiscally responsible. This vision serves as a guide for the planning lifecycle of the Master Plan Update's Goals and Objectives.

The overall vision of the Authority is simply "**Making the world available**."

1.1.1 Mission

The Authority's overall mission for the Airport's Master Plan Update is:

> "**To provide an achievable, flexible, and fiscally responsible development plan that will help ensure that the Airport can accommodate further activity levels, further its position as an international gateway and world-class hub airport, and support aviation-related economic development**."

1.1.2 Core Values

The Authority will remain consistent with its core values throughout the Master Plan Update to:

- Encourage teamwork through collaboration
- Hold itself accountable through decision-making
- Promote customer satisfaction in everything it does
- Ensure respect for its employees and consultants
- Live up to the highest level of integrity through transparency, and foster diversity through the inclusion of disadvantaged business enterprise opportunities to produce the Master Plan Update

1.1.3 Strategic Focus Areas

The vision, mission, and core values are the foundation that supports the overall strategic focus areas as shown on Figure 1-1.

Figure 1-1
WAYNE COUNTY AIRPORT AUTHORITY STRATEGIC FOCUS AREAS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Operational excellence	• Operate safe and secure airports • Maximize airfield efficiency and capacity • Simplify passenger movement and facilitation • Implement environmentally responsible solutions
Financial competitiveness & stability	• Maintain competitive cost structure • Diversify and grow non-airline revenue • Actively manage airport debt
Regional development and growth	• Provide opportunities for development • Support movement of air cargo • Create opportunities for job growth
Customer satisfaction	• Provide a world-class passenger experience • Build business partnerships with airlines & tenants • Grow air service
People	• Live our core values • Equip all employees with critical skills • Develop employees for future roles

In order to translate the voice of the customer into actionable objectives, five critical initiatives were established. The outputs below represent the characteristics defined by the Authority. Critical requirements must be interpreted from a qualitative customer statement into an actionable, quantitative business specification. Establishing critical requirements are vital in understanding what and how to meet customer needs:

1. **Critical to Safety** assures the Authority will address safety and compliance in accordance to FAA requirements and regulations. Ensure that all Airport facilities meet current regulatory requirements and tenant policies, and specifically address federal regulations regarding the preparation and submittal of the FAA required Master Plan Airport Layout Plan. The key measurable characteristics associated with FAA advisory circular aviation safety performance standards that must be met in order to satisfy the Master Plan approval.

2. **Critical to Cost** ensure financial feasibility of recommendations. Given ongoing capital improvements program, prepare a funding plan for the Master Plan Update improvements that aligns limited sources of capital with allowable and optimal uses in order to maximize the Authority's financing capacity for recommended future projects. The key measurable characteristics associated with Airport capital improvement funding and improved revenue performance.

3. **Critical to Quality** will position the Airport to capitalize on future opportunities. Ensure the Airport will remain positioned, and continue to be a strong economic engine in the Detroit region by identifying the highest and best use of underdeveloped property and supporting infrastructure. Identify long-term plans aimed at developing areas for growth demand. The key measurable characteristics associated with the Authority's Airport System Plan, infrastructure planning, as well as Airport land management asset necessary to meet future market opportunities, revenue growth, and aviation capacity needs.

4. **Critical to Customer Satisfaction** enhances the Airport's passenger hub status while maintaining competitiveness. Foster and promote new and existing activities, including tenant expansion into new domestic and global market environments. Ensure tenants are in alignment with potential changes to avoid adversely cost impact to the Authority and travelers. Moreover, evaluate all technical considerations associated with long-term passenger terminal and ground transportation developments while identifying compatible with near-term facilities to enhance the Airport's passenger hub status, optimize operations, and address passenger level of service deficiencies. The key measurable characteristics associated with airport amenities within passenger terminals, ground transportation and parking, as well as other campus-wide services typically used ASQ standards to evaluate customer experience.

5. **Critical to Outreach** provides for a comprehensive stakeholder involvement process. Establish a robust coordination and involvement between alternative development programs and key stakeholders throughout the duration of the Master Plan Update to ensure adequacy of assumptions, acceptance of key findings, and buy-in of recommendations. The key measurable characteristics associated with environmental impact statement awareness and information sharing with internal and external stakeholders in accordance to the National Environmental Policy Act (NEPA).

Input from the entire Airport Authority senior leadership team was incorporated to refine priorities in order to achieve alignment with FAA requirements, and ensure financial feasibility and funding is achievable to sustain the Authority's competitiveness for airlines, tenants, and passengers.

1.2 MASTER PLAN GOALS

The goals for the Master Plan Update are the foundation that drives development alternatives and serve as the ultimate criteria for the selection of a preferred development plan, as well as facilitates other major decisions that are required throughout the planning process. The Master Plan goals were developed in part following a September 2015 strategic planning workshop with Authority staff and were summarized to Authority leadership during a February 2016 Project Steering Committee. The Master Plan Update goals are summarized in the following sections and are presented according to the major functional components of the Airport.

1.2.1 Airfield

Planning goals specifically focused on airfield facilities include the following:

- Plan an operationally efficient future airfield that meets all FAA standards; address and rectify all known modifications to design standards and FAA documented airfield "hot-spots".
- Minimize airfield congestion and potential delays for aircraft operations through procedural changes, new or modified facilities, and/or provision of additional navigational aids, including opportunities provided by Next Gen.
- Review the operational benefits, costs, and implications of extending Runway 3L-21R; consider the results of technical modeling and all user (FAA air traffic control, airlines, etc.) input in this assessment.
- Optimize and facilitate remain overnight parking (RON), deicing and ground hold operations by identifying new or existing facilities to accommodate these activities.

1.2.2 Passenger Terminals

Planning goals specifically focused on the development of the passenger terminal facilities include the following:

- Modify and develop (if necessary) the existing passenger terminal facilities to (1) efficiently accommodate future activity levels, (2) facilitate the expansion needs of existing carriers as well as new entrants, and (3) maintain high levels of passenger satisfaction.
- Ensure long-term passenger comfort and convenience in both terminals by considering factors such as walking distances, terminal-to-terminal connections, and amount and variety of concessions.
- Increase passenger safety by integrating evolving security/U.S. Transportation Security Administration (TSA) requirements in all terminal development options.
- Optimize and efficiently use areas opened for development by demolition of the existing Smith Terminal.

1.2.3 Ground Transportation and Parking Facilities

Planning goals specifically focused on the development of ground transportation and parking facilities include the following:

- Improve vehicular transportation within the Airport campus from all directions and to and from Airport facilities.
- Identify site alternatives for the development of a consolidated rental car center.
- Evaluate and address curbside congestion at both passenger terminals, paying particular attention to congestion and operational issues associated with the McNamara Ground Transportation Center (GTC).
- Identify and evaluate a range of potential strategies to mitigate imbalances on existing and future public parking facilities.
- Improve intra-Airport accessibility, transportation, and roadways, paying particular attention to the long-term location of the maintenance campus.
- Identify optimum locations for existing and future cell phone lot(s).
- Consider and integrate into the preferred development plan local/regional initiatives to improve public transit to and from the Airport.
- Prepare for potential long-term intermodal access to the Airport by addressing appropriate land use options.

1.2.4 Commercial and Economic Development

Planning goals specifically focused on commercial and economic development include the following:

- Identify appropriate locations for commercial and business development opportunities that advance long-term economic interest in the Airport and the region and are consistent with the land use planning and development objectives of local governments.
- Identify opportunities for Airport-related collateral development, such as hotels, offices, retail, and other commercial development that enhance economic development in the region and are compatible with Airport operations.
- Consider highest and best use of vacant properties.
- Provide land use guidelines to inform near- and long-term decisions on potential development opportunities.

1.2.5 Financial and Environmental

Planning goals specifically focused on financial and environmental factors include the following:

- Assess the Authority's financing capacity for near- and long-term capital projects, and ensure that all recommended development plans can be accommodated within the financial boundaries.
- Provide plans that will diversify Airport revenues and strengthen the financial position of the Airport.

- Identify ways in which to develop and operate all Airport facilities in a more economical manner.
- Provide a preferred recommended development plan that is fiscally and environmentally sound and that meets the aviation needs of the Detroit region in a socially responsible manner.
- Seek to minimize adverse environmental impacts that may result from future development.
- Evaluate the need, timing, and viability of future development through appropriate environmental review, and establish the purpose and need for near-term projects to expedite environmental reviews.
- Ensure recommendations are consistent with the Authority's sustainability plans and policies.
- Make use of existing facilities through renewal or modernization versus replacement.

Chapter 2
WAYNE COUNTY AIRPORT AUTHORITY SYSTEM PLAN

The Wayne County Airport Authority System Plan defines the roles for Detroit Metropolitan Wayne County Airport (Detroit Metro) and Willow Run Airport in regard to how each airport will facilitate meeting the region's long-range air transportation needs.

The purpose of the System Plan is to help the Authority (1) facilitate strategies that best leverage the County's two airport assets – Detroit Metro and Willow Run airports, (2) maximize the use and efficiency of existing and planned airport facilities, and (3) optimize previous and future capital investments.

The System Plan was prepared in parallel with master plan updates for both Detroit Metro and Willow Run airports. While the System Plan identifies the roles for each airport, the master plan updates will facilitate the implementation of those roles once approved and adopted by the Authority and the FAA.

The System Plan is developed with consideration of the guidance provided in: Advisory Circular (AC) 150/5070-7, *The Airport System Planning Process;* ACRP Synthesis 14, *Airport System Planning Practices;* and the *Michigan Airport System Plan* (MASP 2008). Input provided by the Authority, FAA, and airport stakeholders is also factored herein.

2.1 AIRPORT SYSTEM SETTING

In August 2002, the Public Airport Authority Act, MCL 259.108-259.125 ("Act 90") established the Wayne County Airport Authority, which assumed operational jurisdiction of Detroit Metro and Willow Run airports (the Wayne County Airport System). The Authority is responsible for the management and oversight of both airports, including the power to plan, promote, maintain, improve, and operate both facilities. Both airports are significant economic assets for the region and each has the ability and capacity to facilitate economic development within the region.

The region served by the Wayne County Airport System includes a primary and secondary area. The primary area is defined as the 10-county Detroit-Warren-Ann Arbor Combined Statistical Area (the Detroit Primary Area or Detroit CSA) which includes the Detroit-Warren-Dearborn Metropolitan Statistical Area (MSA), the Ann Arbor MSA, the Flint MSA, the Monroe MSA, and the Adrian Micropolitan Statistical Area. The primary area includes the counties of Genesee, Lapeer, Lenawee, Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne with a combined population of 5.3 million in 2014, as shown in Table 2-1 and on Figure 2-1.

Table 2-1
DETROIT PRIMARY AREA POPULATION IN 2014
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

County	Population	Percent of total
Wayne	1,764,804	33.2%
Oakland	1,237,868	23.3
Macomb	860,112	16.2
Genesee	412,895	7.8
Washtenaw	356,874	6.7
Livingston	185,596	3.5
St. Clair	160,078	3.0
Monroe	149,824	2.8
Lenawee	99,047	1.9
Lapeer	88,153	1.71
	5,315,251	100.0%

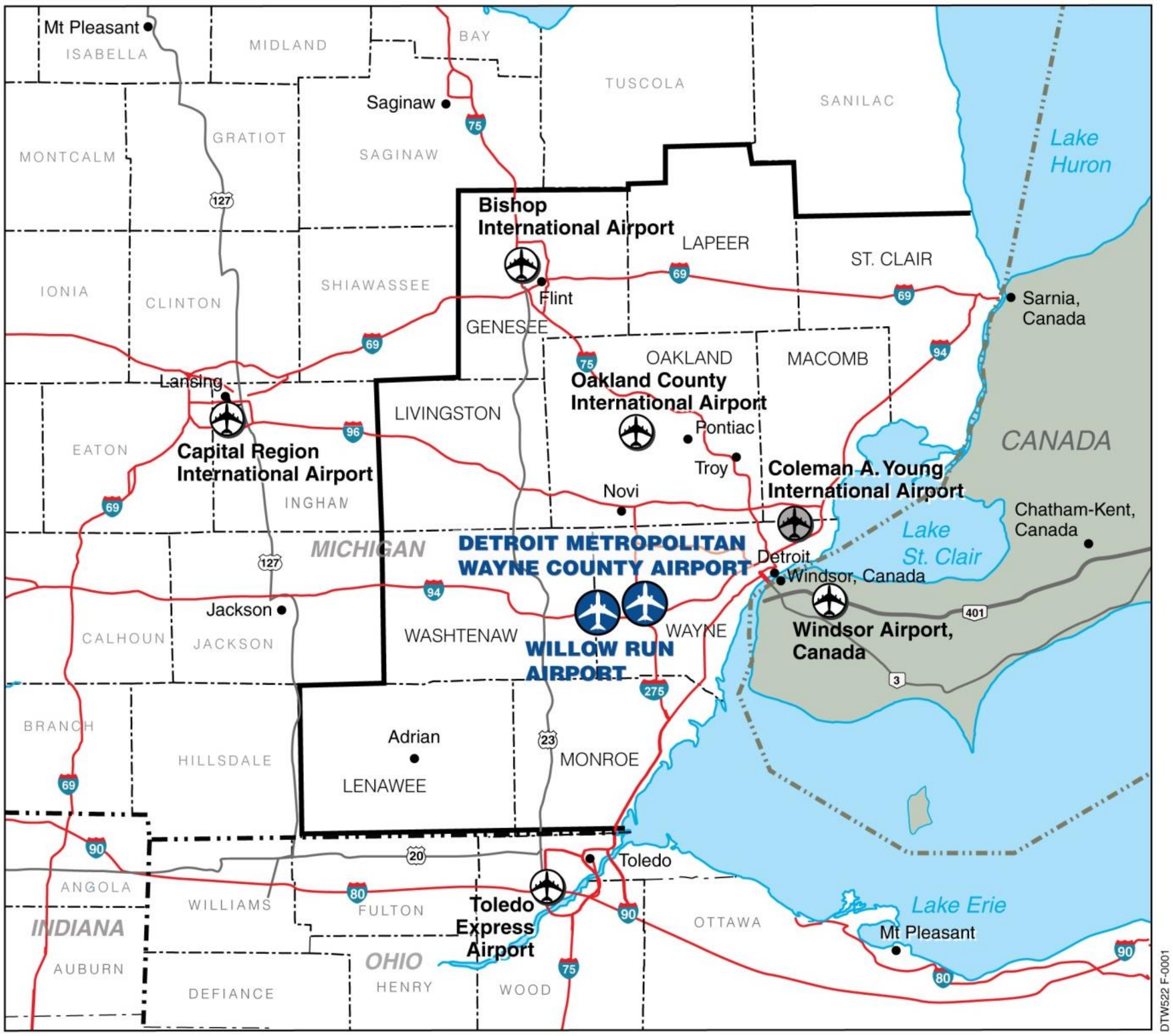
Source: U.S. Department of Commerce, Bureau of the Census, www.census.gov, accessed December 2015.

The secondary area served by the Airport System, which includes many of the counties surrounding the primary area, is defined by the location of and driving distance to other airports, as well as by the availability, price, and quality of service at those other airports. Six airports within 100 miles of the Wayne County Airport System were considered in the System Plan. With the exception of Coleman A. Young International Airport*, each airport provides limited scheduled passenger service as well as accommodates air cargo and general aviation users.

- Windsor International Airport, a Canadian airport located 3 miles east of Detroit with an average of 10 daily departures.
- Pontiac's Oakland County International Airport, a non-hub airport located approximately 29 miles north of Detroit with an average of 1 daily departure.
- Toledo Express Airport, a non-hub airport located approximately 59 road miles southwest of Detroit with an average of 4 daily departures.
- Flint's Bishop International Airport, a small-hub airport located 68 road miles northwest of Detroit with an average of 15 daily departures.
- Lansing's Capital Region International Airport, a non-hub airport located 91 road miles northwest of Detroit with an average of 10 daily departures.

* Coleman A. Young International Airport is owned and operated by the City of Detroit. As of July 2016, the airport does not accommodate passenger or air cargo activity.

Figure 2-1
AIRPORTS IN THE DETROIT PRIMARY AREA
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Primary Area
Wayne County Airport System Airports
Other commercial service airport
Non commercial service airport
International boundary
State boundary
County boundary

Road miles from Detroit to:	
Cleveland	170
Fort Wayne	162
Lansing	91
Flint	68
Toledo	59
Pontiac	29
Windsor	3

Although the location and service provided at these airports are considered in this System Plan, none of these airports are subject to the management and oversight of the Authority, and therefore are not subject to recommendations or findings of this study.

The two airports owned and operated by the Authority are described below.

2.1.1 Detroit Metropolitan Wayne County Airport

Detroit Metro is classified in the FAA's National Plan of Integrated Airport Systems (NPIAS) as a Commercial Service Primary Airport, serving both domestic and international origin-destination (O&D) passengers* and connecting passengers transferring from one flight to another. The Airport has an important role in the global, national, State, and local air transportation systems and is the 17th busiest airport in the United States, in terms of 2015 total passengers (enplaned plus deplaned). The importance of the Airport is reflected in its large origin-destination (O&D) passenger base, its role as the primary connecting hub in Delta's system, and its role as mid-Continental gateway for Delta Air Lines.

- **Origin-Destination Airport** – The Airport's large O&D passenger base is related to the strength of the Airport service region's economy and supports the continued service development by Delta and other airlines at the Airport. In 2015, an estimated 8.9 million outbound O&D passengers boarded flights at the Airport.

- **Connecting Hub** – The Airport serves as an important connecting hub in the route system of Delta Air Lines. The Airport is the third busiest in Delta's system in 2015, with 7.5% of total scheduled departing seats. Delta accounted for approximately 95% of all passengers connecting at the Airport in 2015.

- **International Gateway** – The Airport's role as a developing international gateway is related to the economy of the Detroit Primary Area and the location of global companies, particularly those related to the automotive industry. The Airport is the third busiest international gateway in Delta's system in 2015, with 10.7% of international scheduled departing seats. Delta is the principal U.S. airline in the SkyTeam Alliance, which currently has 20 full members with service to 177 countries in Africa, the Americas, Asia, Europe, and the Pacific. Delta accounted for approximately 84.3% of all international enplaned passengers at the Airport in 2015.

The Airport occupies approximately 6,100 acres within the City of Romulus in Wayne County adjacent to I-94 and I-275. The Airport is approximately 18 miles from downtown Detroit. Figure 2-2 presents the overall Airport site, which includes the following primary components:

- **Airfield** – The airfield occupies about 55% of the total Airport land area, and includes six runways (four north-south parallel runways and two east-west cross-wind runways), and associated taxiways, aprons, hold pads, and other safety-related protection zones. All six runways have the length, width, and pavement strength to accommodate most aircraft operating in the world today. In addition, the Airport includes navigational aids and other facilities that allow the airfield to operate in virtually all weather conditions.

- **Passenger Terminal** – Includes two distinct terminal complexes – Edward H. McNamara and North terminals – that accommodate passenger processing facilities (ticketing, security screening functions, baggage claim, immigration functions, etc.) and all associated aircraft parking and passenger embarking and disembarking facilities (located in the concourses of each terminal).

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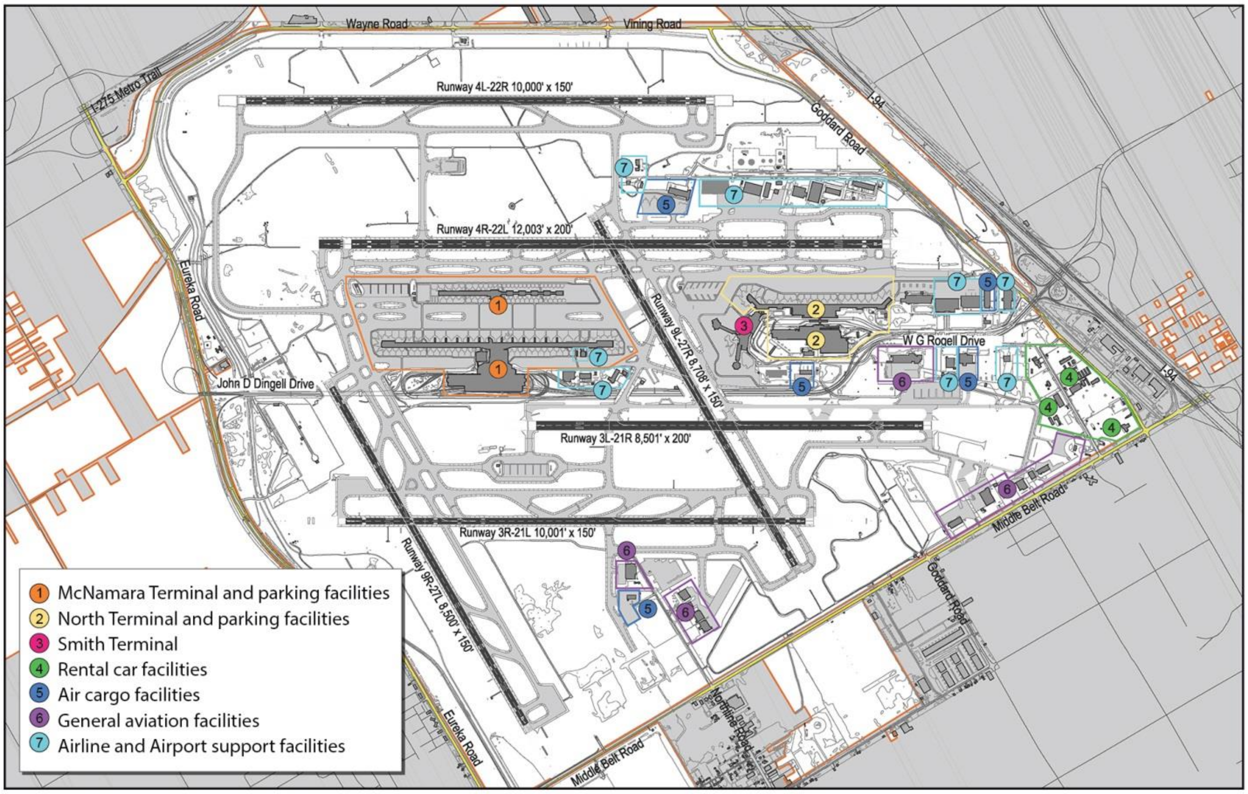
*O&D – Passengers who travel point-to-point to a destination, rather than connecting through a hub to reach their destination. Passengers who begin and end their travels in Detroit.

Figure 2-2
DETROIT METRO AIRPORT SITE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



The McNamara Terminal primarily accommodates Delta, its regional affiliates, and its alliance partners and includes 122 gates; the North Terminal accommodates all other airlines serving the Airport and includes 26 gates. An Authority-owned Westin Hotel is located adjacent to the McNamara Terminal.

- **Ground Transportation and Parking** – Includes access and circulation roadways, public and employee parking garages and surface lots, rental car facilities. There are over 18,000 public parking spaces at the Airport. Structured parking facilities include the Big Blue and McNamara Parking decks, which are located near the passenger terminals to allow for pedestrian access. Both parking facilities have Ground Transportation Centers that provide access to car rental, hotel shuttles, on and offsite parking, and taxis. In addition, there are almost 14,000 additional off-Airport parking spaces provided by third-party operators.

- **Air Cargo** – Air cargo facilities are located in three general areas of Airport property. The largest air cargo tenants, FedEx and UPS, are located in the northwest and southern portion of the Airport, respectively. Several passenger airline and smaller cargo facilities are also located in the northern area of the Airport.

- **General Aviation and Aircraft Maintenance** – General aviation and corporate aviation facilities are located on the northern and southern portions of the Airport. Two fixed base operators (FBO) provide aircraft ground handling, fueling, hangar, maintenance, and passenger servicing. Several aircraft maintenance, repair, and overhaul (MRO) service providers are located in various areas of the Airport that service a wide range of aircraft types.

- **Aviation Support Facilities** – Includes airline maintenance facilities, a fuel farm located in the northwestern section of the airfield, FAA air traffic control facilities, two aircraft rescue and firefighting facilities (ARFF), utilities, and airfield maintenance and support facilities located throughout the site.
- **Commercial Development** – Properties leased to private entities for office, warehouse, and other revenue-generating development.
- **Vacant/Reserve** – Over 2,000 acres (or 33% of the total Airport site) is currently vacant/undeveloped. Large areas of Airport property located south of the Airport were acquired by the Authority for noise mitigation purposes. Although much of this land is currently undeveloped, the areas are available for future aviation and non-aviation related development.

Existing Airport land use is summarized in Table 2-2.

Table 2-2
DETROIT METRO AIRPORT – EXISTING AIRPORT LAND USE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Land use	Area (acres)	Percent of total
Airfield	3,404	55%
Passenger terminal	139	2
Ground transportation and parking	376	6
Air cargo	38	1
General aviation	86	1
Aviation support	131	2
Vacant/reserved	2,032	33
Commercial development	17	>1
Total	6,224	100%

Source: LeighFisher, January 2016.

The Airport's cost per enplanement (CPE) is competitive among peer airports and sustaining that position is imperative to the Authority. Continuously implementing process improvements and efficiencies, economic development, debt management, and long-term financial planning are important to maintaining this position. Because of the residual rate and fee setting methodology* used by the Authority, revenues and expenses must balance. The FY 2015 budget for airline, non-airline, and non-operating revenues is $305.8 million (against $305.8 million in operating and non-operating expenses). Strong revenue growth is achieved from various non-airline sources (parking, car rental, concessions, etc.).

*A residual rate and fee setting methodology sets charges to the airlines based on the net revenue an airport needs to cover expenses including debt service. At the end of the fiscal year airlines are charged for any operating shortfalls or receive a refund if there is a surplus.

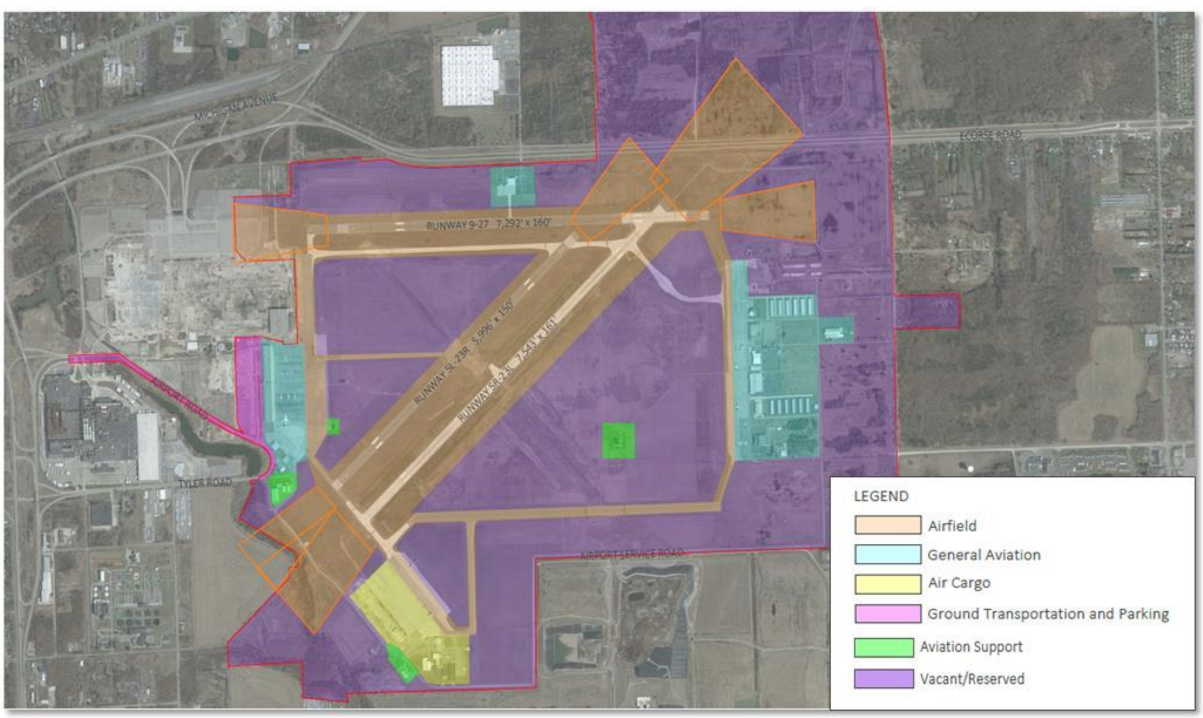
2.1.2 Willow Run Airport

Willow Run is classified in the NPIAS as a "reliever" airport to Detroit Metro, and primarily accommodates on-demand air cargo operators that cannot efficiently be accommodated at Detroit Metro and general aviation activity. According to 2014 data published by the FAA's Air Carrier Activity Information System (ACAIS), Willow Run is the nation's 5th busiest general aviation airport in terms of landed air cargo tonnage.

The airport was originally constructed in 1941 during World War II to support aircraft production. The original airfield consisted of six runways, four of which remain today. The airport's main hangar was used as a passenger terminal from 1946 to 1966 when Willow Run served as the primary commercial service airport for the region. Following development of Detroit Metro, Willow Run was used exclusively for general aviation activity. Beginning in the early 1990s, on-demand / just-in-time air cargo operators specializing in transportation of automotive-related parts and supplies and other freight began to use the facility. Today, Willow Run serves as a base for many of the Detroit regions on-demand / just-in-time cargo operators, including USA Jet, Kalitta Charters, IFL Group, and Ameristar. Willow Run is conducive to their business model as it is conveniently located near the automobile manufacturers and many of their suppliers, does not have operational congestion or other activity constraints, and has historically provided marginally adequate and relatively inexpensive facilities.

The airport is situated between Ypsilanti and Van Buren townships (between Wayne and Washtenaw counties) on approximately 2,600 acres of land north of I-94 and southeast of Michigan Avenue. Figure 2-3 presents the overall airport site, which consists of the following primary components:

Figure 2-3
WILLOW RUN AIRPORT SITE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



- **Airfield** – The airfield occupies almost half (about 40%) of the total land area, and includes three runways (two northeast-southwest oriented parallel runways and one crosswind east-west oriented runway), and associated taxiways, aprons, and other safety-related protection zones.
- **Air Cargo** – Willow Run accommodates air cargo operators who provide on-demand air cargo services that support the movement of manufactured components for the automobile industry in Southeast Michigan. Cargo operators are currently located in the southwest section of the airport.
- **General Aviation** – As a designated general aviation reliever airport to Detroit Metro, Willow Run plays an important role in supporting general aviation activity in the Detroit metropolitan area. A number of prominent businesses in the region base aircraft at the airport, as do recreational general aviation aircraft owners. There are three general aviation terminals are located at the airport operated by AvFlight (in Hangar 1 on the west side of the airfield and in a standalone terminal on the east side of the airfield) and Active Aero (within the Active Aero/USA Jet facility on the east side of the airfield). Eastern Michigan University's Eagle Flight Centre is based at the airport and conducts a significant amount of flight training activity at the airport. In addition, the Yankee Air Museum bases a number of historical World War II military aircraft at the airport.
- **Ground Transportation and Parking** – Tyler Road provides the primary access to the Airport from both the east via Beck Road and the west via Interstate 94 and U.S. Route 12. Parking is available at a surface lot west of Hangar 1 on the west side of the airfield, and at a number of individually maintained lots located adjacent to hangar facilities on the east side of the airfield. Parking is also located adjacent to Kalitta Charters on the south side of the airfield and the Hanz Air hangar on the north side of the airfield.
- **Aviation Support Facilities** – The ARFF is located adjacent to the east apron as is the airfield electrical vault. The snow removal equipment / maintenance facility is also located on the east side of the airfield along Tyler Road while the fuel farm is also located on Tyler Road to the south. The airport traffic control tower (ATCT) is located midfield of the airport with access provided via the east apron.
- **Vacant/Reserve** – Approximately 1,500 acres (or 63%) of the airport property is currently vacant/undeveloped. Pending master plan update findings, these land areas will be reserved for future aviation and non-aviation uses.

Existing airport land use is summarized in Table 2-3.

Table 2-3
WILLOW RUN – EXISTING AIRPORT LAND USE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Land use	Area (acres)	Percent of total
Airfield	640	27%
Air cargo	50	2
General aviation	157	6
Ground transportation and parking	28	1
Aviation support	19	<1
Vacant/reserved	1,486	63
Total	2,380	100%

Source: Mead & Hunt, January 2016.

General aviation activity and air cargo to and from Southeast Michigan has been declining in the past 10 years, which creates a financial challenge for Willow Run. The FY 2015 budget forecasted revenues to be $2.8 million compared to operating expenses of $3.8 million. The Authority has been reducing operating expenses to compensate for revenue losses, but operating revenues from Detroit Metro are used to offset/subsidize the deficit at Willow Run. However, the Authority will not increase the subsidy to Willow Run unless it can be concluded that increased investments would result in reducing the operating deficit.

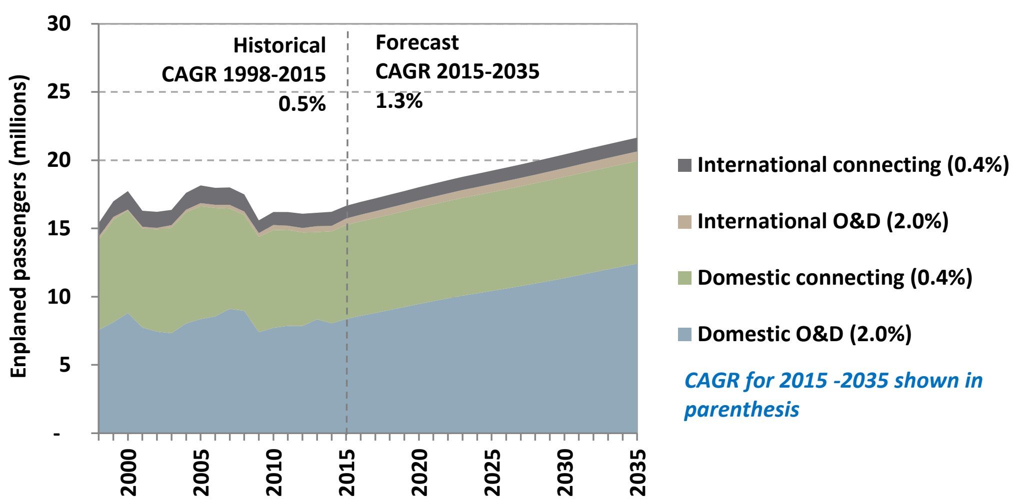
2.2 AVIATION-RELATED MARKETS

Four specific types of aviation-related activity are predominant in the Detroit region. These are commercial passenger activity; cargo activity; MRO services; and general aviation.

2.2.1 Commercial Passengers

Commercial passenger activity consists of domestic and international origin-destination passengers (i.e., passengers beginning or ending their air journeys in Detroit) and connecting passengers transferring from one flight to another. Willow Run does not accommodate any commercial passenger activity. Detroit Metro accommodates the overwhelming majority of commercial passenger activity in the Detroit primary area. As shown on Figure 2-4, the number of total enplaned passengers at the Detroit Metro is forecast to increase from 16.7 million passengers in 2015 to 21.7 million in 2035, increasing an average of 1.3% per year. The number of domestic passengers at the Airport is forecast to increase an average of 1.3% per year between 2015 and 2035, compared with an average increase of 1.0% in international passenger traffic.

Figure 2-4
DETROIT METRO HISTORICAL AND FORECAST ENPLANED PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



CAGR = Compound annual growth rate

Source: Historical—Wayne County Airport Authority records.
Forecast—LeighFisher, March 2016.

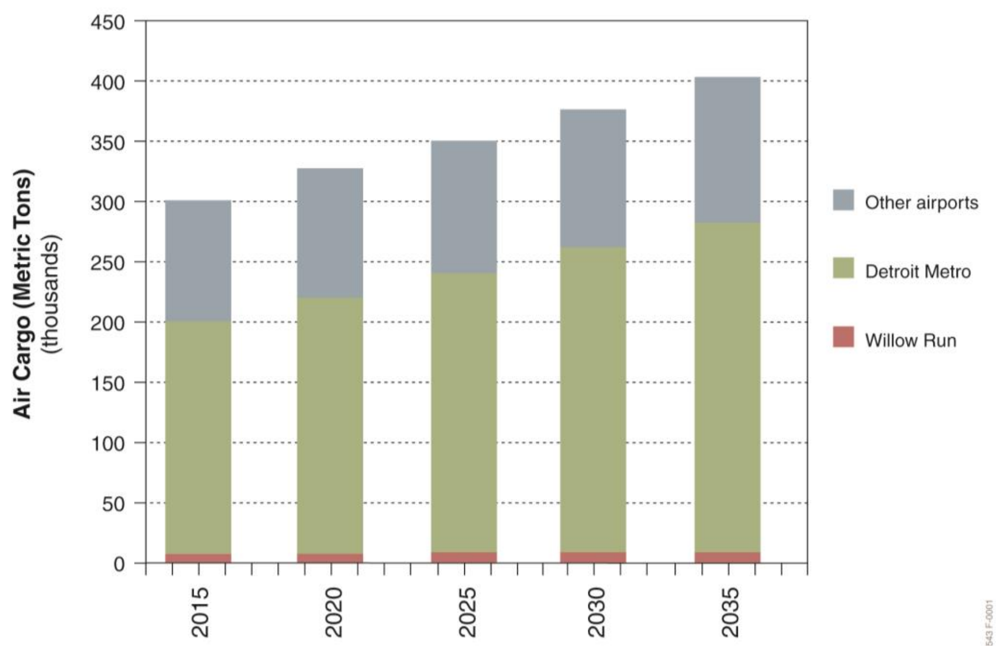
2.2.2 Air Cargo

Air cargo consists of freight accommodated on both passenger and dedicated cargo aircraft and can also involve warehousing and other logistics functions. Currently, air cargo activity is accommodated at both Detroit Metro and Willow Run airports. Detroit Metro primarily accommodates integrated air cargo carriers as well as belly cargo transported on commercial passenger aircraft. Willow Run primarily accommodates on-demand air cargo in support of the region's automotive industry.

As shown on Figure 2-5, in 2015, approximately 301,247 metric tons of air cargo was accommodated in the secondary area served by the Airport System – including Windsor International, Oakland County International, Toledo Express, Bishop International, and Capital Region International airports. Of the total, approximately 64% was accommodated at Detroit Metro; approximately 2% was accommodated at Willow Run; the remaining 33% was accommodated at the other five airports in the secondary area.

Total air cargo in the Detroit Region is forecast to increase from an estimated 301,247 metric tons in 2015 to 405,336 metric tons in 2035—an average of 1.5% per year. The majority of the forecast increase will be accommodated at Detroit Metro. Of the total air cargo forecast for 2035, approximately 67% will be accommodated at Detroit Metro; 2% will be accommodated at Willow Run; the remaining 30% will be accommodated at the other five airports in the secondary area.

Figure 2-5
DETROIT REGION FORECAST AIR CARGO
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Sources: Estimated 2015— Wayne County Airport Authority records, U.S. Census Bureau, Economic Indicators Division, Foreign Trade Statistics, www.census.gov/foreign-trade, U.S. Department of Transportation, T100 and T3 online databases, and Statistics Canada, Air Carrier Traffic at Canadian Airports, 2014, www.statcan.gc.ca, accessed February 2015.
Forecast—LeighFisher, March 2016.

2.2.3 General Aviation

General aviation includes high-end corporate aviation, private/leisure activity, and flight training. This category also includes corporate flight departments and FBOs, which provide a range of services including scheduling, fueling, light maintenance, aircraft sales and service, and apron and hangar storage. General aviation activity is accommodated at both Detroit Metro and Willow Run airports; although Detroit Metro primarily accommodates high-end corporate users, while Willow Run accommodates the full range of general aviation users, including flight training activity.

Itinerant general aviation aircraft operations have steadily declined at Willow Run since 1990 at a compound annual change of -1.2%. However, total itinerant general aviation aircraft operations at Willow Run are forecast to increase from 21,452 operations in 2015 to 26,386 operations in 2035 – at an average of 0.92% per year. Total itinerant general aviation aircraft operations at Detroit Metro have been relatively constant since 1990, and are forecast to remain constant through 2035 at approximately 5,800 annual operations. The split between itinerant general aviation aircraft operations at the two system airports is projected to remain constant between 2015 and 2035 – with 80% accommodated at Willow Run, and the remaining 20% accommodated at Detroit Metro.

Local general aviation aircraft operations (primarily flight training activity) have steadily declined at Willow Run since 1990 at a compound annual change of -2.9%. However, total local general aviation aircraft operations at Willow Run are forecast to increase from 26,206 operations in 2015 to 31,424 operations in 2035 – at an average of 0.82% per year. Detroit Metro does not accommodate flight training activity; and no flight training activity is projected.

2.2.4 Aircraft MRO Services

Aircraft MRO services include both “line” maintenance that typically occurs overnight, and “heavy” maintenance that requires aircraft to be out of service for days or several weeks. MRO services could also include aircraft manufacturing, parts storage, and other related operations.

Detroit Metro accommodates MRO providers. Delta Air Lines is the primary tenant at the Airport and also has dedicated aircraft maintenance hangars. In addition, a new aircraft maintenance hangar for Spirit Airlines is expected to be completed in 2016. In total, Detroit Metro accommodates approximately 408,000 square feet of aircraft maintenance hangar space and associated apron area.

Willow Run accommodates MRO providers that primarily serve aircraft types that conduct operations at the airport – ranging from small single-engine aircraft to larger narrowbody jets used by based on-demand air cargo operators. MRO providers at Willow Run are able to perform a wide range of services including full power plant and airframe repair.

The existing and future market for MRO activities in the Detroit region is difficult to quantify. Although market growth is contingent on overall growth in the aviation industry, additional MRO activity and tenants at either Detroit Metro or Willow Run airports are also contingent on the business and operating decisions of MRO service providers. For instance, in 2014 the Authority entered into discussions/negotiations with Boeing to implement a B-777x production facility at Willow Run. However, Boeing selected another site for the facility based on weather conditions and limited runway length at Willow Run. Nevertheless, the Detroit metropolitan area includes many positive attributes for MRO activity, including a large and skilled local work force and culture, highway networks and connectivity to other manufacturing markets, rail access (at Willow Run), and potential state participation for funding of new facilities.

2.2.5 New and Emerging Markets

In addition to the above, there are new and emerging aviation-related markets that should also be considered. One example is the growing momentum for retail operators, such as Amazon.com, Target, or Walmart, to use unmanned vehicles (i.e., drones) for product delivery. Willow Run could potentially serve as a base for retailers who serve Southeast Michigan.

2.3 SYSTEM PLANNING CONSIDERATIONS

The following summarize a number of important considerations that impact the identification of an appropriate System Plan for the Authority.

- **Single Airport Sponsor** – The Authority has operational jurisdiction for the management and over-sight of both Detroit Metro and Willow Run airports, which includes the power to plan, promote, maintain, improve, and operate both airports. The Authority has the unilateral ability to implement facility or policy changes that can influence the use, cost, and operation of both facilities.

- **Natural Balance** – The existing Airport System has achieved a natural balance with regard to accommodating passengers, cargo, and general aviation activity. This momentum can be difficult to change; and the modification of an existing airport to accommodate new or additional services can be complicated by community, political, and technical factors.

- **Authority's Commitment to Regional Development and Growth** – The Authority is committed to fostering regional economic development. Both airports have sufficient capacity to grow commer-cial airline and cargo services, as well as ample space and infrastructure for on-site commercial development. The Authority's FY 2015-2019 CIP includes multiple projects that promote growth including demolitions to clear land for potential development, construction of additional aprons for cargo activity, and site preparation to attract MRO operators.

- **Commercial Passenger Operations** – All commercial passenger activity is currently accommodated at Detroit Metro, which includes the facilities and infrastructure (passenger terminals, parking garages, etc.) to support such activity. Although Willow Run once accommodated passenger service and initiation of new service has been considered, Willow Run will not reinitiate commercial passenger service given facility limitations and the Authority's operating agreements with existing passenger airlines that prohibit commercial service at Willow Run.

- **Air Service Options** – There are other commercial service airports within 200 miles of the Detroit metropolitan area, including those in the cities of Columbus, Fort Wayne, Cleveland, Lansing, Flint, and Toledo. Although Detroit Metro currently has good domestic and international air service at competitive airfares, residents and visitors to the region could choose to use other commercial service airports if airfares, market options, and customer service at Detroit Metro does not remain competitive.

- **On-demand Air Cargo Operators** – On-demand and heavy lift air cargo operators operate with relatively low profit margins and require a high degree of operational flexibility. These operators are unlikely to relocate to Detroit Metro based on its higher operating costs and the need to reconstruct warehousing and other support facilities. Moreover, if appropriate facilities and infrastructure are not provided at Willow Run, it is possible existing air cargo tenants could relocate to Toledo Express Airport (Ohio), which has the necessary infrastructure and already accommodates a range of air cargo operators.* Potential relocation is driven by anticipated changes in the air cargo fleet mix from older generation commercial service aircraft, to newer generation/NextGen equipped aircraft, such as the B-757. Such newer aircraft would operate from Willow Run with payload restrictions at current runway lengths. Loss of air cargo tenants from Willow Run would adversely impact the Authority's financial management of the airport, as well as the local automotive industry, which relies heavily on on-demand air cargo to support inventory logistics. In addition, there are several established cargo operators that do not operate at Willow Run today despite its superior geographic location. For example, DHL has a distribution warehouse that is located relatively close to Willow Run Airport, but trucks cargo approximately 70 miles from this warehouse to Toledo Express Airport. DHL has indicated they handle approximately 200,000 pounds of cargo each week out of Toledo Express Airport.

- **Integrated Air Cargo Operators** – Currently, integrated air cargo operators at Detroit Metro are unable to perform aircraft-to-truck operations. Although Willow Run could allow for aircraft-to-truck operations, a number of important facility improvements and upgrades – such as enhanced instrumentation for all weather operations and a runway extension – would be required before integrated air cargo operators would consider relocating to Willow Run.

- **Economic Conditions** – An improving economy in the region bodes well for Willow Run Airport's current cargo tenants. With the increase in manufacturing activity in North America, it is likely that the demand for just-in-time deliveries and other cargo operations is expected to increase as well. Because of the geographic location of Willow Run Airport, additional cargo activity will likely be tied to the automotive industry, but could also include other high value manufacturing activities such as electronics or pharmaceuticals.

- **Willow Run Airport Infrastructure** – Much of the original infrastructure and utilities at Willow Run are still in place. Most facilities, including a vast majority of airfield pavements, are reaching the end of their useful life and are in need of repair/overhaul. In addition, a number of key maintenance projects have been postponed or delayed for numerous years.** In addition, anecdotal evidence suggests that infrastructure improvements such as additional runway length and instrumentation may also affect demand at Willow Run Airport. According to several of the Airport's existing cargo operators, airport infrastructure and their ability to serve certain markets with their fleets are major considerations as they make investment and growth decisions.

- **Airport Infrastructure** – The majority of infrastructure and utilities at Detroit Metro are in good condition and well maintained. The Authority has invested over $2.1 billion in passenger terminal development since FY 2000. With the McNamara Terminal and the North Terminal, the Airport has two of the most modern and efficient terminal facilities of any airport in the U.S. with ample capacity to accommodate future growth.

2.4 AIRPORT ROLES

The following summarizes the intended future roles for both Authority-owned airports. The intended roles are primarily a function of (1) existing and future aviation-related demand in the region, (2) the existing natural balance of activity between the two airports, (3) minimization and/or avoidance of significant and/or costly capital improvements, and (4) input provided by stakeholders and airport users.

*In 2013, National Airlines – Willow Run's second largest tenant at the time – relocated out-of-state. The loss of this tenant resulted in a $0.3 million decline in airport revenues (10% percent of total FY 2012 revenue).

**For example, Hangar 1 has been deteriorating and in need of repairs and upgrades for over a decade; appropriate rehabilitation may cost more than construction of a new facility.

2.4.1 Detroit Metropolitan Wayne County Airport

Detroit Metro will continue to serve as the primary commercial service airport for the Detroit metropolitan area and the Southeastern Michigan region. In this role, the Airport will primarily serve the following aviation users:

- Commercial service airlines that accommodate passenger demand in the Detroit region, as well as Delta hub operations for domestic and international service.
- Integrated air cargo carriers and other air cargo operators that desire connectivity with passenger aircraft operations and the regional ground transportation network.
- MRO service providers that service air carrier type aircraft which require the runways and other infrastructure already provided, and MROs that service existing Airport users.
- High-end corporate general aviation activity.

In addition, the County will utilize the airport's existing facilities and vacant/reserved land uses to seek opportunities to maximize revenue generation for the Airport System, as well as allow Detroit Metro to serve as a catalyst for local and regional economic growth and development.

The recommended role for Detroit Metro is based on the following:

- The Airport has sufficient airfield capacity to accommodate the operational banks and peak activity associated with existing and future hubbing activity for Delta Air Lines, the Airport's primary tenant and operator.
- Integrated air cargo carriers would not relocate to another facility since they desire connectivity with commercial passenger aircraft operations.
- Recreational general aviation and general aviation flight training is not compatible with commercial passenger aircraft operations, especially given the operational banks and peak activity associated with existing and future hubbing activity.
- The Airport has sufficient vacant and developed land available to accommodate additional MRO operators and facilities. In addition, the Airport has sufficient apron area and vacant land to accommodate additional corporate general aviation tenants.

2.4.2 Willow Run Airport

Willow Run Airport will serve as the primary reliever airport for the Wayne County Airport System. In this role, the airport will primarily serve the following aviation users:

- On-demand and heavy-lift air cargo operators that support the Detroit region's automotive manufacturing industry
- Aircraft production and MRO service providers that service air carrier and general aviation aircraft
- Corporate and recreational general aviation
- General aviation flight training

In addition, and in order to achieve a more financially viable Airport System, the Authority will preserve appropriate and sufficient land areas for potential (1) new aircraft production and/or MRO operators,

(2) commercial development that may be aviation or non-aviation related, and (3) alternative aviation-related markets that are either in early stages of their life-cycle or not yet realized.

The recommended role for Willow Run is based on the following:

- Given the just-in-time manufacturing processes used by automobile manufactures, the on-demand air cargo operations at Willow Run play a critical role in the economy of Southeast Michigan. Willow Run's existing air cargo tenants primarily provide logistical support to the region's automotive manufacturing industry. On-demand and heavy lift air cargo operators operate with relatively low profit margins and require a high degree of operational flexibility. These operators are unlikely to relocate to Detroit Metro based on its higher operating costs and the need to reconstruct warehousing and other support facilities. Willow Run is conducive to their business model as it is conveniently located near the automobile manufacturers and many of their suppliers, does not have operational congestion or other activity constraints, and has historically provided marginally adequate and relatively inexpensive facilities. In addition, Willow Run is uniquely situated within an international trade corridor with direct access to an interstate highway (Interstate 94), an international railroad (the Canadian Pacific Railway), and located in close proximity to Great Lakes shipping. The airport is ideally situated to accommodate the market associated with air cargo operators who serve the automotive manufacturing industry.

- The airport has sufficient vacant and infrastructure-developed land available to accommodate additional MRO operators and facilities. In addition, the airport has sufficient apron area and vacant land to accommodate additional general aviation tenants.

- Willow Run has closely spaced parallel runways, does not accommodate commercial passenger operations, and on-demand air cargo operations occur sporadically throughout the day. Hence, the shorter parallel Runway 5L-23R can be dedicated to general aviation flight training activity without causing air traffic interruptions to other activity.

Many factors can affect the demand for cargo activity at a particular airport. Reliever airports, such as Willow Run, are often influenced by the activity and policies of nearby airports, in addition to the following: national and regional trends in manufacturing, airport catchment area, air cargo service options, and the cost and convenience of airport facilities. Anecdotal evidence suggests that infrastructure improvements such as additional runway length and instrumentation may also affect demand at Willow Run. According to several of the Airport's cargo operators, airport infrastructure and their ability to serve certain markets with their fleets are major considerations as they make investment and growth decisions. In addition, there are several established cargo operators that do not operate at Willow Run today despite its superior geographic location. For example, DHL has a distribution warehouse located relatively close to Willow Run Airport, yet DHL drives cargo approximately 70 miles from this warehouse to Toledo Express Airport.*

The master plan being developed for Willow Run will review the configuration of the airfield and determine the appropriate runway length required to accommodate its users.

*DHL has indicated they handle approximately 200,000 pounds of cargo each week out of Toledo Express Airport.

Chapter 3
AVIATION ACTIVITY FORECAST

The chapter presents forecasts of aviation activity for enplaned passengers, air cargo, and aircraft operations for the Airport, including passenger, all-cargo, general aviation, and military operations. Using calendar year 2015 as the base year, annual forecasts were prepared for four future demand years—2020, 2025, 2030, and 2035. Authority records (based on data reported by the airlines) were used as the basis for the enplaned passenger, air cargo, and commercial airline aircraft operations forecasts. FAA Air Traffic Activity System (ATADS) data were used as the basis for the total aircraft operations forecasts.

3.1 OVERVIEW AND SUMMARY

The forecasts presented herein are "unconstrained" and, therefore, do not include specific assumptions about physical, regulatory, environmental or other impediments to aviation activity growth. The baseline unconstrained forecasts are the "preferred" forecasts recommended for FAA approval.

3.1.1 Approach

The Airport Master Plan Update forecasts were prepared using a collaborative process which included: (1) a review of previous forecasts prepared for the Airport, including the Master Plan forecasts prepared in 2009 and the FAA 2015 Terminal Area Forecasts (TAF) for the Airport, (2) the collection and analysis of data related to the key issues and trends affecting future aviation demand at the Airport and the Detroit Region,* (3) airline input on future passenger traffic at the Airport, (4) the development of statistical models to identify historical causal factors, and (5) coordination with representatives of the Airport and the FAA.

3.1.2 Enplaned Passengers

Figure 3-1 presents historical enplaned passengers for 1990 through 2015 and forecasts for 2016 through 2035, compared with the 2009 Master Plan forecasts and the FAA 2015 TAF for the Airport. The Master Plan Update enplaned passenger forecasts are based on 2015 data and are within 0.1% of the FAA 2015 TAF in 2020 and 1.8% in 2025.** The enplaned passenger forecast growth rate of 1.3% per year between 2015 and 2035 is lower than the rate forecast by the FAA in its 2015 TAF for the Airport (an average of 1.8% per year) from Federal Fiscal Year (FFY) 2015 to FFY 2035.*** A detailed comparison of the Master Plan Update enplaned passenger forecasts and the FAA 2015 TAF is presented in Chapter 7.

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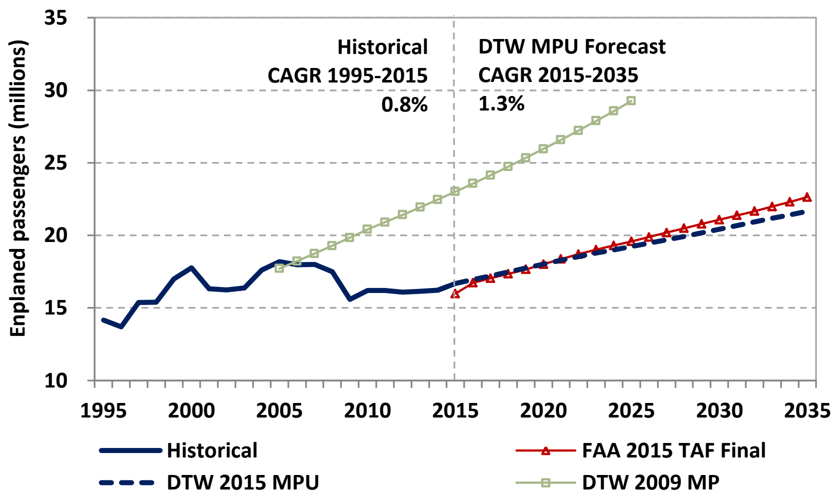
*The Detroit Region, also referred to as the Airport service region in this report, includes a primary and secondary area. The primary area consists of 10 counties, including Genesee, Lapeer, Lenawee, Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne. The secondary area includes the adjacent counties and is defined by the location of and driving distance to other air carrier airports, as well as by the availability, price, and quality of airline service at those other airports.

**U.S. Department of Transportation, Federal Aviation Administration, *Forecasting Aviation Activity by Airport*, July 2001, and *Review and Approval of Aviation Forecasts*, June 2008, http://www.faa.gov.

***The Federal Fiscal Year begins on October 1 and ends on September 30.

Figure 3-1
HISTORICAL AND FORECAST ENPLANED PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

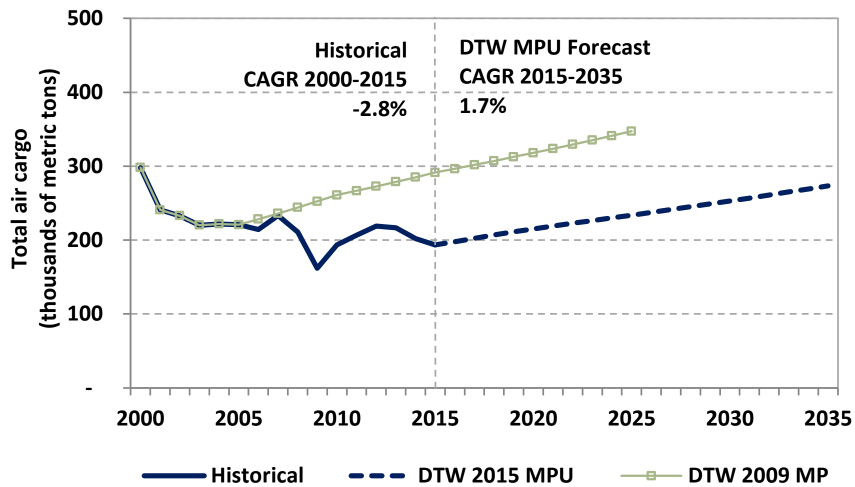
CAGR = Compound annual growth rate

Sources: Historical—Wayne County Airport Authority records.
The Airport 2015 MPU Forecast—LeighFisher, February 2016.
FAA 2015 TAF Final—Final version provided by U.S. Department of Transportation, Federal Aviation Administration to Wayne County Airport Authority.
The Airport 2009 MP—Jacobsen|Daniels Associates, November 2009.

3.1.3 Air Cargo

Figure 3-2 presents historical air cargo (in metric tons) for 1990 through 2015 and forecasts for 2016 through 2035. (The FAA does not prepare cargo forecasts for individual airports as part of the TAF.) Since 2000, the cargo industry nationwide and at the Airport has experienced significant changes related to: (1) air cargo security regulations by the FAA and TSA, (2) consolidation in the air cargo industry, (3) an increasing trend in the volume of cargo transported by truck, (4) the national and global economic recessions, (5) use of all-cargo carriers by the U.S. Postal Service to transport mail, and (6) increased use of mail substitutes (e.g., email). Total cargo (enplaned and deplaned air freight and mail) is forecast to increase an average of 1.7% per year between 2015 and 2035 at the Airport as shown on Figure 3-2.

Figure 3-2
HISTORICAL AND FORECAST AIR CARGO
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

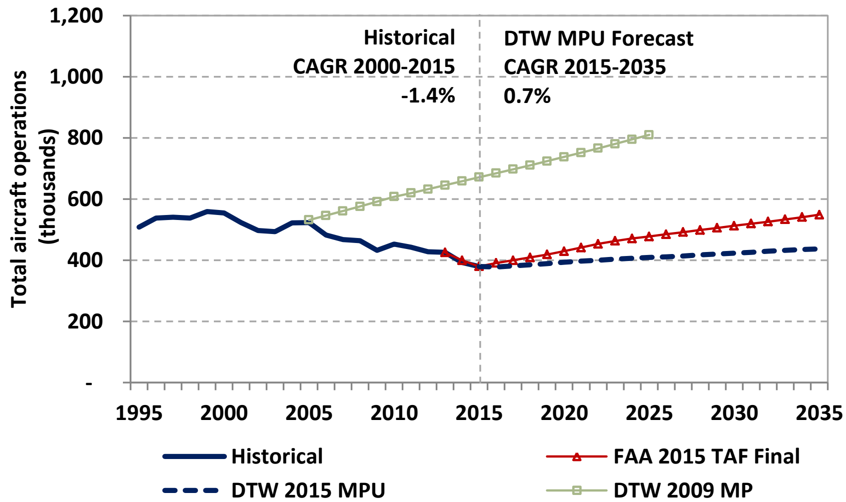
CAGR = Compound annual growth rate

Sources: Historical—Wayne County Airport Authority records.
The Airport 2015 MPU Forecast—LeighFisher, February 2016.
The Airport 2009 MP Forecast—Jacobsen|Daniels Associates, November 2009.

3.1.4 Aircraft Operations

Figure 3-3 presents historical total aircraft operations for 1990 through 2015 and forecasts for 2016 through 2035, compared with the 2009 Master Plan forecasts and the FAA 2015 TAF for the Airport. Total aircraft operations include air carrier, air taxi and commuter, general aviation, and military takeoffs and landings. The total aircraft operations forecasts are based on 2015 data and are within 8.5% of the FAA 2015 TAF in 2020 and 14.9% in 2025. The forecast average growth rate in total aircraft operations of 0.7% per year between 2015 and 2035 is lower than the rate forecast by the FAA in its 2015 TAF for the Airport (an average of 1.9% per year) from FFY 2015 to FFY 2035. A detailed comparison of the Master Plan Update aircraft operations forecasts and the FAA 2015 TAF is presented in Section 3.7.

Figure 3-3
HISTORICAL AND FORECAST AIRCRAFT OPERATIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

CAGR = Compound annual growth rate

Sources: Historical—Wayne County Airport Authority records.
The Airport 2015 MPU Forecast—LeighFisher, February 2016.
FAA 2015 TAF Final—U.S. Department of Transportation, Federal Aviation Administration, www.faa.gov, accessed February 2016.
The Airport 2009 MP Forecast: Jacobsen|Daniels Associates, November 2009.

3.1.5 Airport Service Region

For the purposes of this study, the region served by the Airport includes a primary and secondary area. The primary area of the Airport service region is defined as the 10-county Detroit-Warren-Ann Arbor Combined Statistical Area (the Detroit Primary Area or Detroit CSA) which includes the Detroit-Warren-Dearborn Metropolitan Statistical Area (MSA), the Ann Arbor MSA, the Flint MSA, the Monroe MSA, and the Adrian Micropolitan Statistical Area. The Detroit Primary Area includes the counties of Genesee, Lapeer, Lenawee, Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne with a combined population of 5.3 million in 2014, as shown in Table 3-1 and on Figure 3-4. Because economic growth and activity within the primary area stimulate a significant portion of passenger demand at the Airport, statistics for these 10 counties were used to evaluate aviation activity trends at the Airport.

Table 3-1
DETROIT PRIMARY AREA POPULATION IN 2014
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

County	Population	Percent of total
Wayne	1,764,804	33.2%
Oakland	1,237,868	23.3
Macomb	860,112	16.2
Genesee	412,895	7.8
Washtenaw	356,874	6.7
Livingston	185,596	3.5
St. Clair	160,078	3.0
Monroe	149,824	2.8
Lenawee	99,047	1.9
Lapeer	88,153	1.71
	5,315,251	100.0%

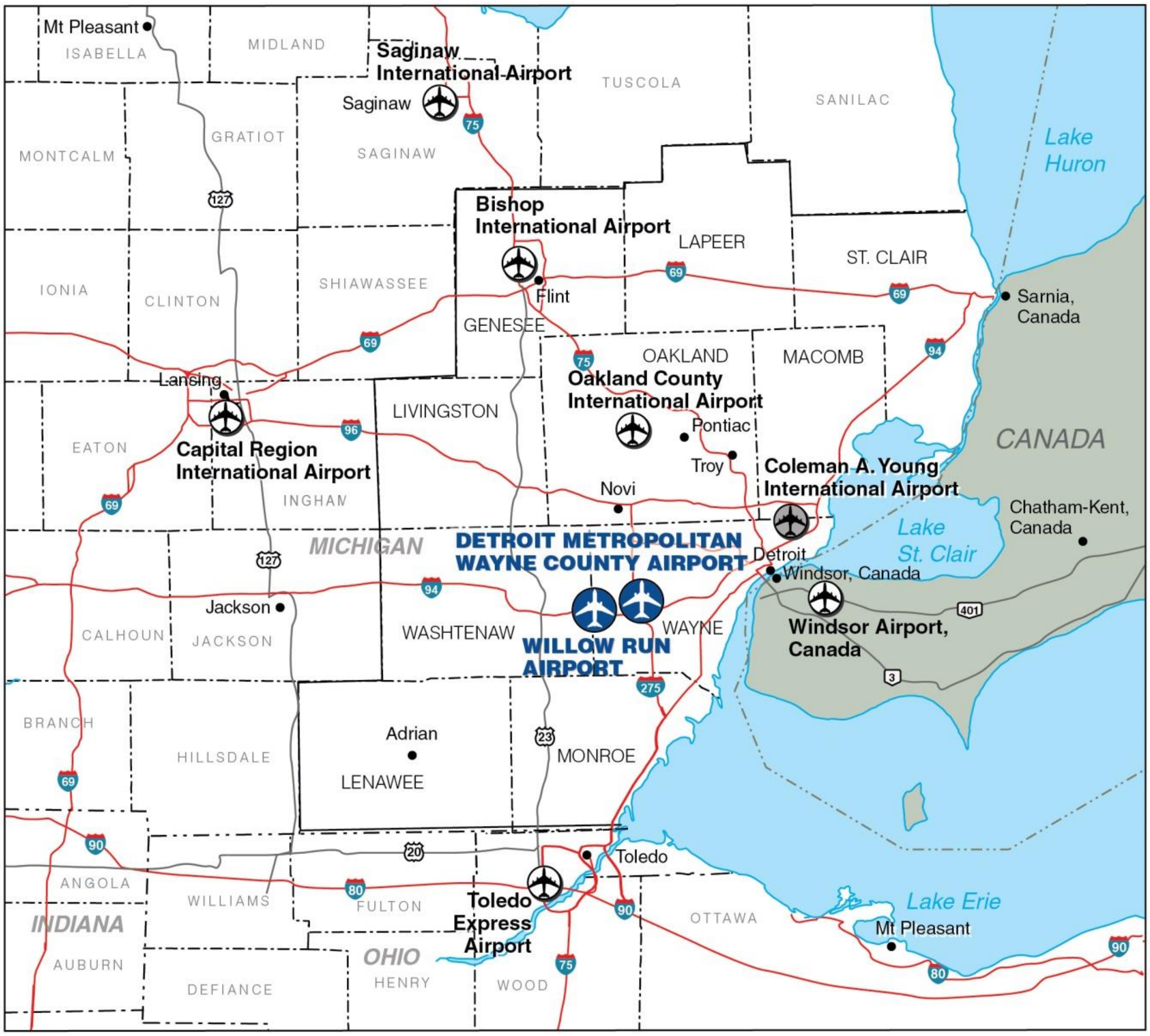
Source: U.S. Department of Commerce, Bureau of the Census, www.census.gov, accessed December 2015.

The secondary area served by the Airport, which includes many of the counties surrounding the 10-county primary area, is defined by the location of and driving distance to other air carrier airports, as well as by the availability, price, and quality of airline service at those other airports. Six airports with commercial passenger airline service are within 100 miles of Detroit and provide limited scheduled airline service (as of July 2016):

- Windsor International Airport, a Canadian airport located 29 road miles east of the Airport with an average of 10 daily departures.
- Pontiac's Oakland County Airport, a non-hub airport located 39 road miles north of the Airport with an average of one daily departure.
- Toledo Express Airport, a non-hub airport located 65 road miles southwest of the Airport with an average of four daily departures.
- Flint's Bishop International Airport, a small-hub airport located 79 road miles northwest of the Airport with an average of 15 daily departures.
- Lansing's Capital Region International Airport, a non-hub airport located 98 road miles northwest of the Airport with an average of 10 daily departures, including five to the Airport.
- Saginaw International Airport, a non-hub airport located 136 road miles northwest of the Airport with an average of nine daily departures, including five to the Airport.

In addition, Fort Wayne International Airport, a non-hub airport with an average of 23 daily departures in July 2016 (including three to the Airport), is located approximately 162 road miles southwest of the Airport. Cleveland-Hopkins International Airport, a medium-hub airport with an average of 145 daily departures in July 2016 (including four to the Airport), is located approximately 170 road miles southeast of the Airport.

Figure 3-4
AIRPORT SERVICE REGION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Primary Area
Wayne County Airport System Airports
Other commercial service airport
Non commercial service airport
International boundary
State boundary
County boundary

Road miles from Detroit Metropolitan Wayne County Airport to:	
Fort Wayne	157
Grand Rapids	147
Cleveland	146
Saginaw	136
Kalamazoo	124
Lansing	98
Flint	79
Toledo	65
Pontiac	39
Windsor	29

Note: Road miles shown are from DTW to the airports located in each city listed.
Source: Google Maps, www.google.com.

3.1.6 Domestic and International Role

The role of an airport is important in evaluating the domestic and international components of aviation activity and preparing forecasts. The Airport has an important role in the global, national, State, and local air transportation systems and is the 17th busiest airport in the United States, in terms of 2014 total passengers (enplaned plus deplaned). The importance of the Airport is reflected in its large origin-destination (O&D) passenger base, its role as the primary connecting hub in Delta's system, and its role as mid-Continental gateway for Delta Air Lines.

3.1.6.1 Airport's Role as an Origin-Destination Airport

The Airport's large O&D passenger base is related to the strength of the Airport service region's economy and supports the continued service development by Delta and other airlines at the Airport. In 2015, an estimated 8.9 million outbound O&D passengers boarded flights at the Airport (i.e., these O&D passengers did not connect with another flight at the Airport).

3.1.6.2 Airport's Role as a Connecting Hub

The Airport serves as an important connecting hub in the route system of Delta Air Lines. The Airport is the third busiest in Delta's system in 2015, with 7.5% of total scheduled departing seats. Atlanta's Hartsfield-Jackson International Airport ranked first in Delta's system with 23.4% of total scheduled departing seats in 2015, followed by Minneapolis-St. Paul International Airport with 7.7%. Delta accounted for approximately 95% of all passengers connecting at the Airport in 2015.

3.1.6.3 Airport's Role as an International Gateway

The Airport's role as a developing international gateway is related to the economy of the Detroit Primary Area and the location of global companies, particularly those related to the automotive industry. The Airport is the third busiest international gateway in Delta's system in 2015, with 10.7% of international scheduled departing seats, as shown in Table 3-2. The Airport's role as a major international gateway in Delta's system compliments its domestic connecting hub at the Airport, with approximately 80% of its international passengers connecting at the Airport in 2015. The Airport accounted for the largest share of Delta's seats to destinations in Asia and the South Pacific in 2015, with 24.1%. Delta accounted for approximately 84.3% of all international enplaned passengers at the Airport in 2015, with the remaining 15.7% provided by one U.S. airline (Spirit) and five foreign-flag airlines (Air Canada, Air France, Lufthansa, Royal Jordanian, and Virgin Atlantic). In 2015, approximately 65% of the international passengers enplaned at the Airport by airlines other than Delta were O&D passengers. Delta is the principal U.S. airline in the SkyTeam Alliance which currently has 20 full members with service to 177 countries in Africa, the Americas, Asia, Europe, and the Pacific.

Table 3-2
DELTA AIR LINES' INTERNATIONAL GATEWAYS IN THE UNITED STATES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

U.S. gateway	Africa/ Middle East	Asia/ Southwest Pacific	Europe	Latin America/ Caribbean	Canada	Total	Percent of total
	Schedule departing seats from U.S. airports by international region						
Atlanta	269,846	106,506	1,307,817	3,691,887	336,210	5,712,266	36.1%
New York (JFK)	169,395	102,432	1,571,800	1,365,571	201,955	3,411,153	21.5
Detroit	**--**	**515,596**	**691,616**	**262,138**	**227,236**	**1,696,586**	**10.7**
Minneapolis/St. Paul	--	101,457	460,383	180,870	504,755	1,247,465	7.9
Los Angeles (LAX)	--	336,651	55,952	554,492	53,492	1,000,587	6.3
Seattle	--	451,401	310,172	7,938	168,909	938,420	5.9
U.S. gateways	439,241	1,614,043	4,397,740	6,062,896	1,492,557	14,006,477	88.4
Other U.S. airports	--	523,086	818,592	286,825	201,374	1,829,877	11.6
Total seats	439,241	2,137,129	5,216,332	6,349,721	1,693,931	15,836,354	100.0%
	Percent of total						
Atlanta	61.4%	5.0%	25.1%	58.1%	19.8%	36.1%	
New York (JFK)	38.6	4.8	30.1	21.5	11.9	21.5	
Detroit	--	24.1	13.3	4.1	13.4	10.7	
Minneapolis/St. Paul	--	4.7	8.8	2.8	29.8	7.9	
Los Angeles (LAX)	--	15.8	1.1	8.7	3.2	6.3	
Seattle	--	21.1	5.9	0.1	10.0	5.9	
U.S. gateways	100.0	75.5	84.3	95.5	88.1	88.4	
Other U.S. airports	0.0	24.5	15.7	4.5	11.9	11.6	
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Source: OAG Aviation Worldwide Ltd, OAG Analyser database, accessed July 2016.

3.2 ECONOMIC BASIS FOR AIRLINE TRAFFIC

Generally, regions with large populations, high levels of employment, and high average per capita incomes will generate strong demand for airline travel. The demographics and economy of the region—as measured by changes in population, employment, and per capita income—as well as airline service and airfares—are typically the most important factors affecting O&D passenger demand. In 2015, approximately 53% of the Airport's passengers were O&D passengers; the remaining 47% were connecting passengers.

The following sections present a discussion of the economic basis for airline traffic at the Airport—the historical population, nonagricultural employment, and per capita income of the Detroit Primary Area, comparative unemployment rates, and conventions and tourism. Also provided is a summary of the economic outlook for world regions, the United States, Michigan, and the Detroit Primary Area.

3.2.1 Population

Historically, population growth in the Detroit Primary Area and the State has lagged growth in the nation. From 1990 to 2015, population in the Detroit Primary Area and Michigan increased an average of 0.1% and 0.3% per year, respectively, while population in the nation increased an average of 1.0% per year, as shown in Table 3-3. The Southeast Michigan Council of Governments (SEMCOG)* projects population in the Detroit Primary Area to increase an average of less than 0.1% per year between 2015 and 2035, compared with forecast increases of less than 0.1% per year than in the State and 0.8% per year in the nation.

3.2.2 Employment

From 2000 to 2010, nonagricultural employment in the Detroit Primary Area decreased an average of 2.2% per year, reflecting the effects of two national economic recessions, the financial credit crisis, and the bankruptcies of two major Detroit auto manufacturers, as shown in Table 3-3. Since the end of the recession in 2009, nonagricultural employment growth in the Detroit Primary Area has returned, with an average increase of 1.3% per year between 2010 and 2015. SEMCOG projects nonagricultural employment in the Detroit Primary Area to increase an average of 0.3% per year between 2015 and 2035, compared with forecast increases of 0.4% per year than in the State and 0.7% per year in the nation.

3.2.3 Income

From 1990 to 2014 (the most recent year available), per capita personal income in the Detroit Primary Area increased an average of 0.6% per year, slower than that for the State (an average of 0.7% per year) and the nation (an average of 1.1% per year), as shown in Table 3-3. Similar to employment trends, per capita income growth in the Detroit Primary Area has returned since the end of the 2009 recession, with an average increase of 1.7% per year between 2010 and 2015, faster than that for the State (an average of 1.6% per year) and the nation (an average of 1.3% per year). SEMCOG projects per capita personal income in the Detroit Primary Area to increase an average of 1.7% per year between 2014 and 2035.

3.2.4 Unemployment Rates

In addition to the employment trends discussed earlier, the unemployment rate is also indicative of general economic conditions. Table 3-4 shows comparative annual unemployment rates in the Detroit Primary Area, the State, and the nation as a whole for 2000 through 2015. Unemployment rates in the Detroit Primary Area have generally followed but remained higher than national trends since 2001.

*SEMCOG region includes the counties of Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne.

Table 3-3
HISTORICAL AND PROJECTED SOCIOECONOMIC DATA
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Population (thousands)			Nonagricultural employment (thousands)			Per capita income (2014 dollars)		
	Detroit Primary Area	State of Michigan	United States	Detroit Primary Area	State of Michigan	United States	Detroit Primary Area	State of Michigan	United States
Historical									
1990	5,187	9,295	248,791	1,284	3,944	109,527	37,744	34,322	35,485
2000	5,457	9,939	281,425	1,326	4,676	132,024	46,029	41,275	42,071
2010	5,319	9,884	308,746	1,060	3,864	130,361	40,761	38,214	43,727
2011	5,309	9,877	311,719	1,076	3,952	131,932	41,962	39,301	44,679
2012	5,312	9,887	314,103	1,093	4,034	134,175	42,782	39,854	45,643
2013	5,315	9,901	316,427	1,103	4,110	136,381	42,639	39,833	45,159
2014	5,315	9,916	318,907	1,115	4,182	138,958	43,662	40,740	46,049
2015	n.a.	9,923	321,419	1,130	4,244	141,865	n.a.	n.a.	n.a.
Projected									
2020	5,284	10,013	334,818	1,144	4,379	148,304	50,142	46,695	50,637
2025	5,286	10,030	348,413	1,161	4,448	152,639	54,018	50,304	54,140
2030	5,320	10,012	362,516	1,179	4,518	157,117	57,906	54,192	57,723
2035	5,354	9,993	377,191	1,197	4,589	161,727	62,689	58,380	61,505
	Compound annual percent increase (decrease)								
Historical									
1990-2000	0.5%	0.7%	1.2%	0.3%	1.7%	1.9%	2.0%	1.9%	1.7%
2000-2010	(0.3)	(0.1)	0.9	(2.2)	(1.9)	(0.1)	(1.2)	(0.8)	0.4
2010-2015	(0.0) *(a)*	0.1	0.8	1.3	1.9	1.7	1.7 *(a)*	1.6 *(a)*	1.3 *(a)*
1990-2015	0.1 *(a)*	0.3	1.0	(0.5)	0.3	1.0	0.6 *(a)*	0.7 *(a)*	1.1 *(a)*
Projected									
2015-2020	(0.1) *(a)*	0.2	0.8	0.3	0.6	0.9	2.3 *(a)*	2.3 *(a)*	1.6 *(a)*
2020-2025	0.0	0.0	0.8	0.3	0.3	0.6	1.5	1.5	1.3
2025-2030	0.1	0.0	0.8	0.3	0.3	0.6	1.4	1.5	1.3
2030-2035	0.1	0.0	0.8	0.3	0.3	0.6	1.6	1.5	1.3
2015-2035	0.0 *(a)*	0.0	0.8	0.3	0.4	0.7	1.7 *(a)*	1.7 *(a)*	1.4 *(a)*

Note: The Detroit Primary Area includes Genesee, Lapeer, Lenawee, Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne counties.

(a) Represents the increase from 2014.

Sources: Historical—U.S. Department of Commerce, Bureau of the Census, www.census.gov, U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov, U.S. Department of Commerce, Bureau of Economic Analysis, www.bea.gov, accessed January 2016. Adjusted to constant 2014 dollars using the U.S. Department of Labor, Consumer Price Index for Urban Consumers (1982-84 = 100), www.bls.gov. Historical growth rates for income are through 2014, the latest year available.
Projected—Southeast Michigan Council of Governments (SEMCOG), *Retrenchment and Renewal, The Economic and Demographic Outlook for Southeast Michigan through 2040*, March 2012. University of Michigan, Institute for Research on Labor, Employment, and the Economy, *The Economic and Demographic Outlook for Michigan through 2040*, March 2012. U.S. Congressional Budget Office, *An Update to the Budget and Economic Outlook: 2015 to 2025*, August 20155, www.cbo.gov. Projections for 2035 were extrapolated by LeighFisher based on projected growth rates between 2020 and 2025. U.S. Census Bureau, Population Division, *Table 1. Projections of the Population and Components of Change for the United States: 2015 to 2060*, December 2014, www.census.gov.

Table 3-4
COMPARATIVE UNEMPLOYMENT RATES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

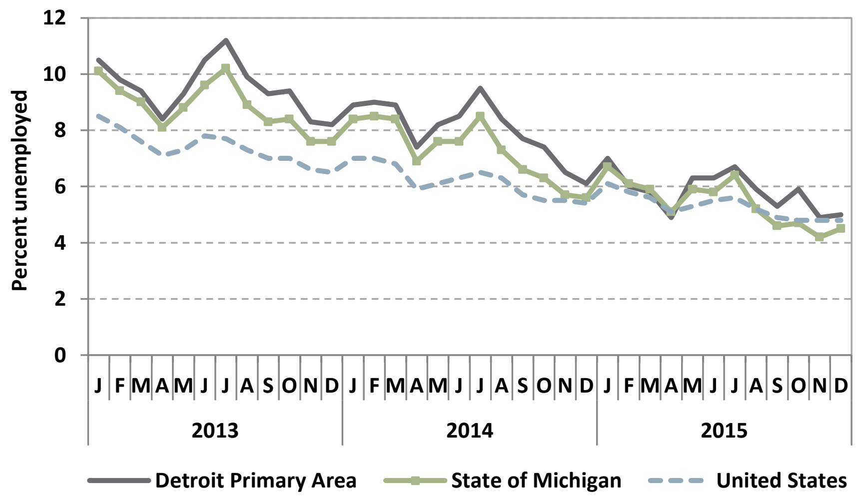
	Detroit Primary Area	State of Michigan	United States
2000	3.4%	3.6%	4.0%
2001	5.0	5.2	4.7
2002	6.2	6.3	5.8
2003	7.1	7.2	6.0
2004	7.1	7.0	5.5
2005	6.8	6.8	5.1
2006	7.0	7.0	4.6
2007	7.1	7.0	4.6
2008	8.2	8.0	5.8
2009	14.6	13.7	9.3
2010	13.4	12.6	9.6
2011	11.0	10.4	8.9
2012	9.7	9.1	8.1
2013	9.5	8.8	7.4
2014	8.0	7.3	6.2
2015	5.8	5.4	5.3

Note: Unemployment rates are not seasonally adjusted.

Source: U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov, accessed March 2016.

Since the end of the recession in June 2009, monthly unemployment rates in the Detroit Primary Area, the State of Michigan, and the United States have decreased, as shown on Figure 3-5. In December 2015, the unemployment rate (unadjusted) for the Detroit Primary Area was 5.0%, higher than the State (4.5%) and the nation (4.8%).

Figure 3-5
MONTHLY UNEMPLOYMENT TRENDS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: Unemployment rates are not seasonally adjusted.

Source: U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov, accessed March 2016.

3.2.5 Nonagricultural Employment by Sector

Figure 3-6 shows a comparative distribution of nonagricultural employment by industry sector for the Detroit Primary Area in 2010 and in 2015, and for the State and the nation in 2015.

- ***Business Services*** – Business services in the Detroit Primary Area accounted for the largest share of nonagricultural employment, with 19.5% in 2010 and 21.1% in 2015. From 2010 to 2015, the Detroit Primary Area's employment in business services increased an average of 2.8% per year, with the strongest growth in professional, business, finance, and information services.*

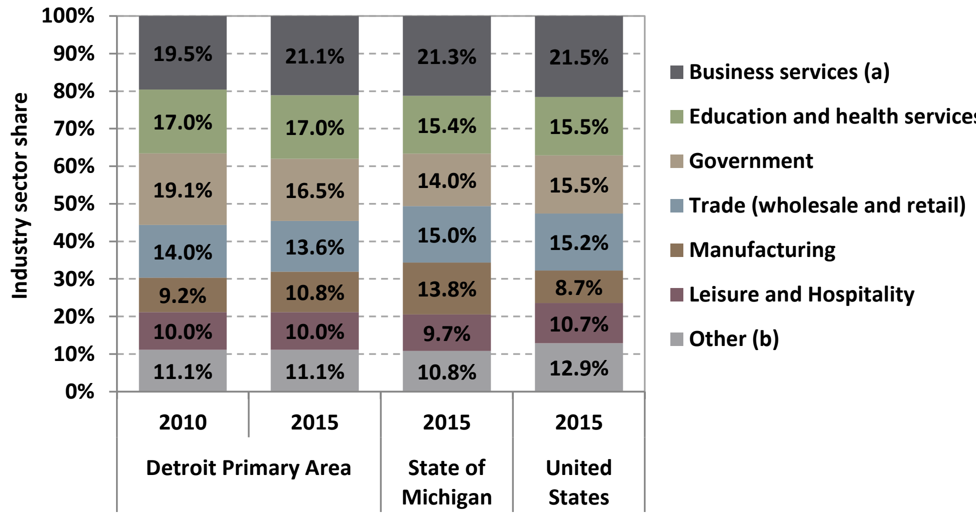
- ***Education and Health Services*** – Employment in education and health services in the Detroit Primary Area increased an average of 1.2% per year between 2010 and 2015. The share of education and health services employment in the Detroit Primary Area maintained a market share of 17.0% in 2010 and 2015.

- ***Government*** – Employment by federal, State, and local government agencies** accounted for the third largest share of nonagricultural employment and decreased an average of 1.7% per year between 2010 and 2015. The share of government employment in the Detroit Primary Area decreased from 19.1% in 2010 to 16.5% in 2015.

*Information services includes traditional, Internet, and software publishing; the motion picture and sound recording industries; the broadcasting industries; the telecommunications industries; Web search portals, data processing industries; and the information services industries.

**As reported by the U.S. Department of Labor, Bureau of Labor Statistics, government employment includes only civilian employees.

Figure 3-6
COMPARATIVE DISTRIBUTION OF NONAGRICULTURAL EMPLOYMENT
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



(a) Includes professional and business services, finance, and information.
(b) Includes mining, construction, transportation, and public utilities.

Source: U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov, accessed March 2016.

- **Trade** – Trade is comprised of wholesale and retail trade. From 2010 to 2015, the Detroit Primary Area's employment in trade increased an average of 0.6% per year, reflecting growth in both wholesale and retail trade. The share of trade employment in the Detroit Primary Area decreased from 14.0% in 2010 to 13.6% in 2015.

- **Manufacturing** – Manufacturing employment in the Detroit Primary Area experienced the strongest employment growth of any industry sector between 2010 and 2015—an average increase of 4.5% per year, reflecting the recovery of the regional economy and automotive industry. The share of manufacturing employment in the Detroit Primary Area increased from 9.2% in 2010 to 10.8% in 2015.

- **Leisure and Hospitality Services** – The Detroit Primary Area's employment in leisure and hospitality services increased an average of 1.2% per year between 2010 and 2015. Leisure and hospitality services in the Detroit Primary Area maintained a market share of 10.0% in 2010 and 2015.

- **Other Activities** – Other employment in the Detroit Primary Area increased an average of 1.3% per year between 2010 and 2015. The share of other employment in the Detroit Primary Area remained unchanged with 11.1% in 2010 and 2015.

3.2.6 Industry Clusters

The economy of the Detroit Primary Area is driven by companies that export goods and services nationally and globally, bringing in new investment and jobs that support economic growth as well as air service development. Companies that make up industry clusters, also referred to as the "traded sector," tend to *cluste*r because they draw competitive advantage from their proximity to competitors, to a skilled workforce, to specialized suppliers, and to a shared base of sophisticated knowledge about their industry.

The Detroit Regional Chamber identifies five industry clusters in the Detroit Primary Area.

- **Automotive** – The Detroit Primary Area is recognized as the center of the global automotive industry. As home to the Big Three automakers—General Motors, Ford, and Chrysler (FCA US), the Detroit Primary Area is a center for the trade of automotive imports and exports, auto-related research and development, and supporting industries such as motor vehicle parts manufacturers and tool and die companies. In addition, Detroit attracts a highly skilled workforce with a high concentration of industrial and mechanical engineers that support the auto industry. According to the Michigan Department of Treasury, Michigan motor vehicle production increased 11.2% between November 2014 and November 2015 (the most recent data available) and accounted for more than 19.5% of U.S. vehicle production.*

- **Defense** – In 2015, the Detroit Region was home to 3,307 businesses serving the defense industry which together support over 94,000 jobs, with annual average wages of more than $90,000. The Detroit region is a central site for military research and development facilities and purchasing centers, including the Tank Automotive Research, Development, and Engineering Center; TACOM Life Cycle Management Command, Selfridge Air National Guard Base, and the Michigan Defense Center.

- **Healthcare** – According to Detroit Regional Chamber, the health care industry in the Detroit Primary Area includes more than 13,000 health care-related businesses which provide 366,000 jobs in the region and has an overall economic impact of $36 billion annually. The Detroit Region's healthcare industry is supported by the research conducted at Michigan State University, Oakland University, Wayne State University, the University of Detroit-Mercy, and the University of Michigan and the clinical trials performed at the Detroit Medical Center, Henry Ford, and Beaumont hospitals.

- **Information Technology** – The information technology sector in the Detroit Primary Area provided more than 61,000 jobs in 2014 with an average salary of $92,000, according to Detroit Regional Chamber. Major information technology companies in the Detroit Region include Compuware, Syntel, and Tata Technologies.

- **Global Logistics** – The Detroit Primary Area's transportation, distribution, and logistics infrastructure is extensive, including nine intermodal assets, three marine ports, eight rail yards, nine airports and air fields, and interstates that reach from Canada to Mexico via Detroit. According to the Detroit Regional Chamber, good exports from the State of Michigan supported over 270,000 jobs, nearly 75% of which are in the Detroit Primary Area.

3.2.7 Major Employers

Table 3-5 lists the 10 largest employers in the Detroit Region in 2014 (the most recent year available). The three largest employers—Ford Motor Company, General Motors Corporation, and Fiat Chrysler Automobiles—together accounted for 113,000 employees. Although the auto industry continues to be an important employer in the Detroit Primary Area, the Detroit economy has become increasingly diverse and less affected by changes in the auto industry. As noted in Section 2.5, business services and education and healthcare sectors account for 38.1% of total employment in the Detroit Primary Area with approximately 430,000 jobs in 2015.

*Michigan Department of Treasury, *Michigan Economic Update*, November 2015, www.michigan.gov/treasury.

Table 3-5
MAJOR EMPLOYERS IN THE DETROIT REGION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

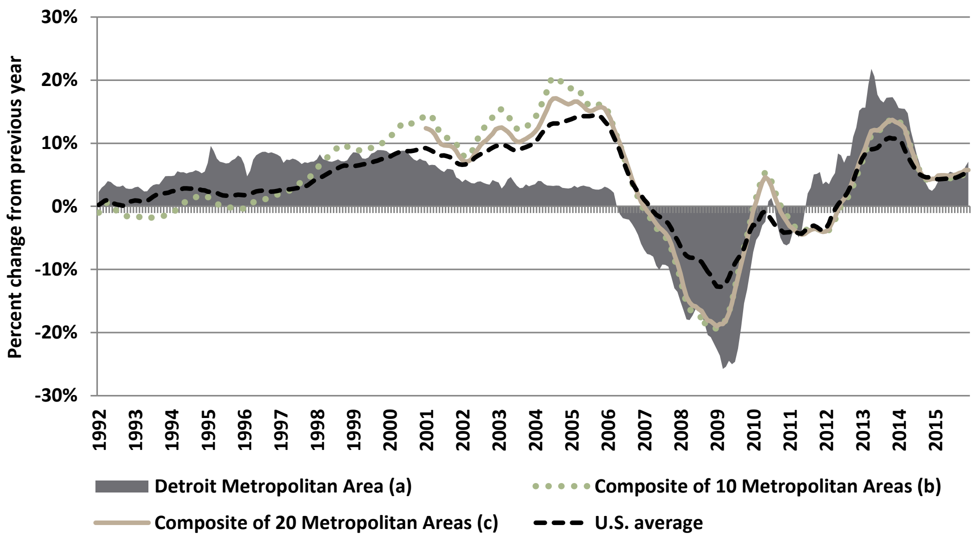
Rank	Company	Regional headquarters	Number of employees
1	Ford Motor Company	Dearborn	42,750
2	General Motors Corporation	Detroit	39,561
3	Fiat Chrysler Automobiles (FCA)	Auburn Hills	30,579
4	University of Michigan	Ann Arbor	29,855
5	U.S. Government	Detroit	19,010
6	Henry Ford Health System	Detroit	17,949
7	Beaumont Health System	Royal Oak	16,456
8	Trinity Health	Livonia	13,687
9	Detroit Medical Center	Detroit	11,868
10	U.S. Postal Service	Detroit	11,600

Source: Crain's Detroit Business as reported by the Detroit Regional Chamber, www.detroitchamber.com.

3.2.8 Regional Housing Market

Figure 3-7 presents the percent change in home prices for Detroit and composites for 10 and 20 selected metropolitan areas from January 1992 through December 2015, based on the Standard & Poor's/Case-Shiller Home Price Index. Between 2000 and 2005, home prices in Detroit increased an average of approximately 5%, less than the 10% to 15% gains recorded in other U.S. metropolitan areas. Home prices in Detroit began to decrease in May 2006, before the start of the economic recession in December 2007, and continued to decrease through June 2011. Since then, Detroit housing prices have increased each month, with slower but continued growth since August 2014.

Figure 3-7
PERCENT CHANGE IN HOME PRICES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: Data begins in 1991 for Detroit and in 2011 for the composite of 20 metropolitan areas.

(a) Includes data for the Detroit MSA.
(b) Includes Boston, Chicago, Denver, Las Vegas, Los Angeles, Miami, New York, San Diego, San Francisco, and Washington, D.C.
(c) Includes Atlanta, Charlotte, Cleveland, Dallas, Detroit, Minneapolis, Phoenix, Portland, Seattle, and Tampa in addition to the areas mentioned above.

Source: Standard & Poor's/Case-Shiller Home Price Indices, www.standardandpoors.com, accessed March 2016.

3.2.9 Conventions and Tourism

Conventions and tourism represent an increasingly important source of economic activity in the Detroit Primary Area. The leisure and hospitality sector in the Detroit Primary Area provided 113,000 jobs in 2015. Detroit points of interest include the Henry Ford Museum, the North American International Auto Show, Detroit's Cultural Center, the Motown Museum, Sea Life Michigan Aquarium, the Detroit Zoo, the Michigan Science Center, and sporting venues at Comerica Park and Ford Field. In 2014 (the most recent year available), the State of Michigan hosted more than 113 million visitors with total spending of $22.8 billion (3.8% more than in 2013).*

The Detroit Primary Area is an increasingly popular location for meetings and conventions. According to the Detroit Metro Convention and Visitors Bureau, more than 1.3 million people attended conventions at the Cobo Center in 2015. The Cobo Convention Center, a 2.4 million square foot complex with 725,000 square feet of exhibition space and 75 meeting rooms, is located on the bank of the Detroit River and is the centerpiece of downtown Detroit's civic center.

*Tourism Economics, *The Economic Impact of Travel in Michigan*, Tourism Satellite Account, Calendar Year 2014.

3.2.10 Economic Outlook

The economic outlook for the United States, the State of Michigan, and the Detroit Primary Area forms a basis for anticipated growth in airline traffic at the Airport. Economic activity in the Detroit Primary Area and the State is directly linked to the production of goods and services in the world and the rest of the United States. Both airline travel and the movement of cargo through the Airport depend on the economic linkages between and among the regional, State, national, and global economies. The economic and other assumptions underlying the forecasts of enplaned passengers are based on a review of global, national, State, and regional economic outlooks as well as an analysis of historical socioeconomic trends and airline traffic trends, as presented in the section titled "Historical Passenger Airline Traffic."

3.2.10.1 Global Economy

Globalization of the world economy has created linkages between national economies that relate not only to trade but also to air travel. The Detroit Primary Area and the State have strong linkages to the global economy through its primary industry sectors, particularly the automotive industry, and the five world regions (Asia, Canada, Europe, Latin America, and the Middle East) that are currently served at the Airport. The economic growth of these world regions, in terms of Gross Domestic Product (GDP), is directly related to the growth in air travel. Projections of GDP for the world regions are shown in Table 3-6. Continued growth in the economies of the world regions most closely aligned with the Detroit economy and airline service at the Airport are expected to contribute to continued growth in passenger traffic at the Airport.

Table 3-6
HISTORICAL AND PROJECTED GDP GROWTH BY WORLD REGION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Average annual percent increase (decrease) in GDP (constant U.S. dollars)		
	Historical		Forecast
World region	1990-2000	2000-2014	2014-2035
Asia	n.a.	4.8%	4.3%
Canada	1.9%	1.6	1.5
Europe *(a)*	(1.2) *(b)*	2.5	2.4
Latin America	3.6	3.2	3.4
United States	3.4	1.8	2.4
World	1.8	3.3	3.1

n.a. = not available

(a) Data are for the countries that have adopted the Euro.
(b) Percent change between 1991 and 2000.

Source: Global Insight as reported in U.S. Department of Transportation, Federal Aviation Administration, *FAA Aerospace Forecasts, Fiscal Years 2015-2035*, March 2015.

3.2.10.2 U.S. Economy

The U.S. economy has grown at a slow to moderate pace since the 2008-2009 economic recession. In January 2016, the Congressional Budget Office (CBO) projected U.S. economic growth, as measured by U.S. GDP in constant dollars, to increase 2.5% in 2016 and 2.6% in 2017, and then settle into a longer-term 2.0%

rate of growth through 2026. The CBO projects that the unemployment rate will decrease to 4.7% in 2016 and 4.4% in 2017, then increase to 4.6% in 2017, 4.8% in 2018, and average 5.0% through FY 2021.*

3.2.10.3 Michigan Economy

In its January 2016 economic and revenue outlook, the Michigan Department of Treasury forecast continued economic growth for the State of Michigan through 2018.** In particular:

- Wage and salary employment is forecast to increase 1.3% in 2016, 1.4% in 2017, and 1.0% in 2018.
- Unemployment rate is forecast to continue to decrease each year with the rate falling to 4.9% in 2016, 4.7% in 2017, and 4.6% in 2018.
- Wages and salaries are forecast to increase 4.7% in 2016, 4.0% in 2017, and 3.8% in 2018.

Long-term economic forecasts for the State of Michigan are presented in Table 3-3.

3.2.10.4 Detroit Economy

In March 2012, SEMCOG completed its long-range regional economic forecast through 2040.*** SEMCOG's forecasts are used for land-use and transportation planning. SEMCOG expects that future economic growth in southeast Michigan will be affected by the U.S. economy, the automotive industry, and investments in education and training to promote the diversification of the regional economy. In addition, SEMCOG expects that regional demographic trends will be important in the future, in terms of the size and growth of the labor force in supporting economic activity and influencing the level of consumer purchases. SEMCOG forecasts slow economic growth for the Detroit Primary Area between 2015 and 2035, including:

- Population growth of less than 0.1% per year, reflecting a continuation through 2030 of the outmigration trends experience since 2000.
- Nonagricultural employment growth of 0.3% per year, with the strongest growth expected in education and healthcare services.
- Per capita income growth, in constant dollars, of 1.7% per year.

3.2.10.5 Economic Basis for Forecast Aviation Demand

The economic outlook for world regions, the United States, the State of Michigan, and the Detroit Primary Area form a basis for anticipated growth in aviation demand at the Airport. Employment and income projections for the Detroit Primary Area and the State of Michigan are for slow to moderate economic growth, particularly in the automotive industry, defense sector, education and health care services, information technology, and global logistics. Factors expected to contribute to economic growth in the Detroit Primary Area and associated increases in airline travel include: (1) the diversity in the economic base, which lessens its vulnerability to weaknesses in particular industry sectors, (2) growth in the existing and emerging Detroit industry sectors described earlier, (3) an educated labor force able to support the development of knowledge-based and service industries, and (4) continued reinvestment to support the development of tourism, conventions, and other businesses. This outlook is reflected in the aviation demand forecasts presented in Section 3.6.

*Congressional Budget Office, Economic Outlook: Fiscal Years 2016-2026, January 2016, www.cbo.gov.
**Michigan Department of Treasury, Economic and Revenue Outlook, January 2016, www.michigan.gov/treasury.
***Southeast Michigan Council of Governments (SEMCOG), Retrenchment and Renewal, The Economic and Demographic Outlook for Southeast Michigan through 2040, March 2012.

3.3 HISTORICAL PASSENGER AIRLINE TRAFFIC

Historical and future passenger airline traffic is influenced by a number of factors including (1) the diversity of airline service at an airport, (2) the passenger market shares of the airlines providing service, (3) trends in national and international passenger traffic, and (4) passenger traffic at other airports in the region.

3.3.1 Airlines Serving the Airport

The Airport is served by 25 passenger airlines, including 4 network airlines, 12 regional affiliates of which four are associated with more than one network airline, 4 low-cost carriers, and 5 foreign-flag airlines, as shown in Table 3-7.

Table 3-7
PASSENGER AIRLINES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Network airlines	Regional airlines (affiliation)	Low cost carriers	Foreign-flag airlines
Alaska Airlines	Air Wisconsin (American)	Frontier Airlines *(a)*	Air Canada
American Airlines *(b)*	Compass (Delta)	jetBlue Airways	Air France
Delta Air Lines *(c)*	Endeavor (Delta)	Southwest Airlines *(d)*	Lufthansa Airlines
United Airlines *(e)*	Envoy (American)	Spirit Airlines	Royal Jordanian
	ExpressJet (Delta)		Virgin Atlantic Airways
	GoJet (Delta, United)		
	Mesa (United)		
	PSA (American)		
	Republic (American, United)		
	Shuttle America (Delta, United)		
	SkyWest (American, Delta, United)		
	TransStates (American)		

(a) Frontier was acquired by Indigo Partners LLC in December 2013 and restructured its airfares in 2014 to that of an "ultra" LCC, i.e., a low cost airline with a simplified fare structure and a la carte pricing.
(b) American completed its merger with US Airways on December 9, 2013.
(c) Delta completed its merger with Northwest on October 29, 2008.
(d) Southwest completed its merger with AirTran on May 2, 2011.
(e) United completed its merger with Continental on October 1, 2010.

Sources: Wayne County Airport Authority records and OAG Worldwide Aviation Ltd, OAG Analyser database, accessed March 2016.

3.3.2 Enplaned Passengers

Between 2000 and 2015, the number of enplaned passengers at the Airport decreased an average of 0.2% per year, with annual variations, as shown in Table 3-8 and on Figure 3-8. The Airport passenger traffic remained relatively unchanged between 2000 and 2005 (an average increase of 0.1% per year). Between 2005 and 2010, the period including the 2008-2009 recession, and bankruptcies in the Detroit Region auto industry, the number of passengers at the Airport decreased an average increase of 2.2% per year. Between 2010 and 2015, passenger traffic growth returned, increasing an average of 0.6% per year, including a 2.9% increase between 2014 and 2015, reflecting a 2.5% in scheduled departing seats, including additional service by Spirit, Southwest, and jetBlue and new service by Virgin Atlantic.

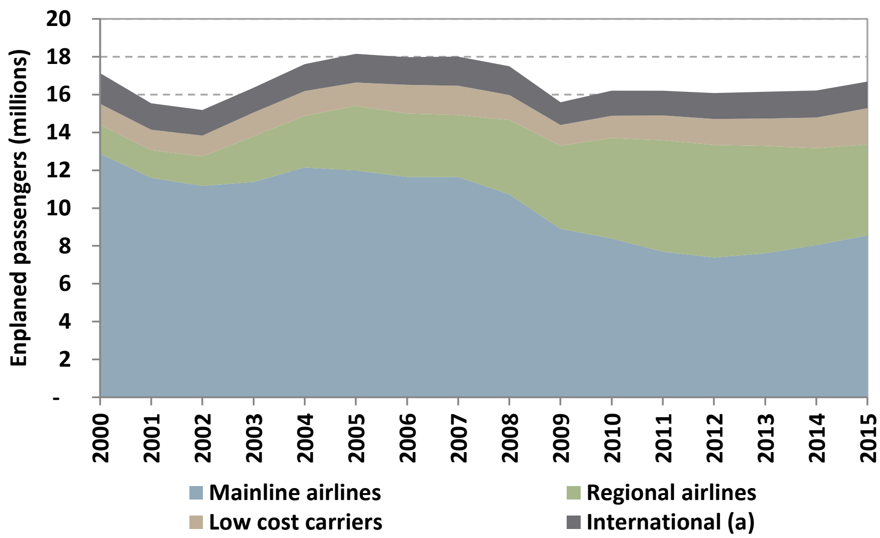
Table 3-8
HISTORICAL ENPLANED PASSENGERS BY AIRLINE TYPE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Domestic				International			Total
Year	Network airlines *(a)*	Regional airlines *(b)*	Low cost carriers	Total	U.S. airlines *(a)*	Foreign-flag airlines *(a)*	Total	enplaned passengers
2000	12,877,089	1,526,582	1,107,780	15,511,451	1,311,695	310,004	1,621,699	17,133,150
2001	11,601,799	1,459,004	1,079,659	14,140,462	1,234,861	163,110	1,397,971	15,538,433
2002	11,172,821	1,556,481	1,101,851	13,831,153	1,160,045	192,027	1,352,072	15,183,225
2003	11,379,368	2,405,075	1,265,513	15,049,956	1,145,187	164,522	1,309,709	16,359,665
2004	12,147,390	2,726,408	1,311,106	16,184,904	1,275,716	147,493	1,423,209	17,608,113
2005	11,984,318	3,413,539	1,236,508	16,634,365	1,333,528	184,540	1,518,068	18,152,433
2006	11,640,695	3,353,817	1,519,673	16,514,185	1,278,299	183,365	1,461,664	17,975,849
2007	11,643,718	3,272,350	1,549,850	16,465,918	1,321,921	217,511	1,539,432	18,005,350
2008	10,723,333	3,931,625	1,323,102	15,978,060	1,277,775	240,035	1,517,810	17,495,870
2009	8,903,022	4,389,107	1,098,210	14,390,339	1,038,615	164,121	1,202,736	15,593,075
2010	8,393,468	5,309,385	1,174,233	14,877,086	1,175,072	152,518	1,327,590	16,204,676
2011	7,695,168	5,887,780	1,317,350	14,900,298	1,140,724	161,651	1,302,375	16,202,673
2012	7,388,202	5,950,905	1,369,473	14,708,580	1,209,304	161,148	1,370,452	16,079,032
2013	7,611,193	5,672,378	1,449,645	14,733,216	1,254,707	160,249	1,414,956	16,148,172
2014	8,047,705	5,116,245	1,620,529	14,784,479	1,262,445	166,810	1,429,255	16,213,734
2015	8,555,457	4,799,655	1,924,013	15,279,125	1,214,182	192,778	1,406,960	16,686,085
				Percent increase (decrease)				
2010-2011	(8.3%)	10.9%	12.2%	0.2%	(2.9%)	6.0%	(1.9%)	0.0%
2012-2013	3.0	(4.7)	5.9	0.2	3.8	(0.6)	3.2	0.4
2013-2014	5.7	(9.8)	11.8	0.3	0.6	4.1	1.0	0.4
2014-2015	6.3	(6.2)	18.7	3.3	(3.8)	15.6	(1.6)	2.9
				Compound annual percent increase (decrease)				
2000-2005	(0.1%)	1.5%	0.2%	0.1%	0.0%	(0.9%)	(0.1%)	0.1%
2005-2010	(6.9)	9.2	(1.0)	(2.2)	(2.5)	(3.7)	(2.6)	(2.2)
2010-2015	0.4	(2.0)	10.4	0.5	0.7	4.8	1.2	0.6
2000-2015	(2.7)	7.9	3.7	(0.1)	(0.5)	(3.1)	(0.9)	(0.2)

(a) Includes passengers enplaned on charter airlines.
(b) Includes passengers enplaned on Canadian airlines (pre-cleared and counted as domestic).

Sources: 2000-2002—U.S. Department of Transportation, Schedule T100, online database, accessed March 2016.
2003-2015—Wayne County Airport Authority records.

Figure 3-8
HISTORICAL ENPLANED PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: Data are for domestic enplaned passengers, except as noted. See Table 3-8.

(a) Includes U.S. and foreign-flag airline enplaned passengers.

Sources: 2000-2002—U.S. Department of Transportation, Schedule T100, online database, accessed March 2016.
2003-2015—Wayne County Airport Authority records.

3.3.2.1 Enplaned Passengers by Airline Type

Passenger traffic of network airlines such as American, Delta, and United at the Airport has decreased since 2000 (an average decrease of 2.7% per year between 2000 and 2015), reflecting the increasing use of regional affiliates, as shown in Table 3-8. Although regional airlines experienced the strongest growth in passenger traffic at the Airport between 2000 and 2015 (an average increase of 7.9% per year), the number of regional airline passengers has decreased since 2012 with the retirement of 50-seat regional jets and increases in network airline passengers. Low cost carrier passengers at the Airport increased an average of 3.7% per year between 2000 and 2015, with stronger growth between 2010 and 2015 (an average of 10.4% per year). International enplaned passengers on U.S. and foreign-flag airlines increased an average of 1.2% per year between 2010 and 2015, following decreases between 2000 and 2010.

3.3.2.2 Enplaned Passengers by Terminal

As shown in Table 3-9, the McNamara Terminal accounted for 76.1% of enplaned passengers at the Airport in 2015, with the North Terminal accounting for the remaining 23.9%. Delta Air Lines and its regional affiliates accounted for 99.2% of McNamara Terminal enplaned passengers in 2015, with two foreign-flag airlines—Air France* and Virgin Atlantic Airways—accounting for the remaining 0.8%. In the North Terminal, domestic enplaned passengers accounted for 97.1% of total in 2015, with low cost carriers ranking first with 48.2%, followed by network airlines (28.8%), and regional airlines (20.2%). International enplaned passengers accounted for the remaining 2.9% of North Terminal passengers in 2015.

*Delta Skyteam airline partner.

Table 3-9
HISTORICAL ENPLANED PASSENGERS BY TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Terminal	Enplaned passengers 2013	Enplaned passengers 2014	Enplaned passengers 2015	Percent of total 2013	Percent of total 2014	Percent of total 2015
McNamara Terminal						
Domestic						
Delta Air Lines						
Network	6,633,247	6,911,702	7,406,571	51.5%	54.9%	58.3%
Regional affiliates	4,942,833	4,386,236	3,996,183	38.4	34.8	31.5
Subtotal—Domestic	11,576,080	11,297,938	11,402,754	89.9%	89.7%	89.8%
International						
Delta Air Lines	1,219,736	1,224,721	1,186,390	9.5%	9.7%	9.3%
Foreign-flag airlines	77,185	74,429	104,829	0.6	0.6	0.8
Subtotal—International	1,296,921	1,299,150	1,291,219	10.1	10.3	10.2
McNamara Terminal Total	12,873,001	12,597,088	12,693,973	100.0%	100.0%	100.0%
North Terminal						
Domestic						
Airlines other than Delta Air Lines						
Network *(a)*	977,946	1,136,003	1,148,886	29.9%	31.4%	28.8%
Regional affiliates *(b)*	729,545	730,009	803,472	22.3	20.2	20.1
Low cost carriers	1,449,645	1,620,529	1,924,013	44.3	44.8	48.2
Subtotal—Domestic	3,157,136	3,486,541	3,876,371	96.4%	96.4%	97.1%
International						
U.S. airlines other than Delta Air Lines *(a)*	34,971	37,724	27,792	1.1%	1.0%	0.7%
Foreign-flag airlines	83,064	92,381	87,949	2.5	2.6	2.2
Subtotal—International	118,035	130,105	115,741	3.6	3.6	2.9
North Terminal Total	3,275,171	3,616,646	3,992,112	100.0%	100.0%	100.0%
Total Airport						
McNamara Terminal	12,873,001	12,597,088	12,693,973	79.7%	77.7%	76.1%
North Terminal	3,275,171	3,616,646	3,992,112	20.3	22.3	23.9
Total Airport	16,148,172	16,213,734	16,686,085	100.0%	100.0%	100.0%

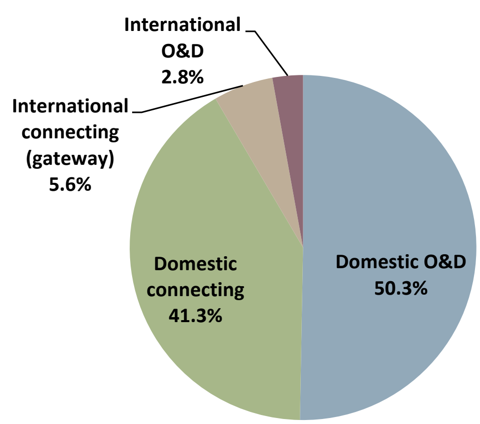
(a) Includes passengers enplaned on charter airlines.
(b) Includes passengers enplaned on Canadian airlines (pre-cleared and counted as domestic).
Source: Wayne County Airport Authority records.

3.3.3 Origin-Destination and Connecting Passengers

Table 3-10 presents the estimated distribution of enplaned passengers between outbound O&D passengers (i.e., residents of and visitors to the Detroit Region on outbound flights from the Airport) and passengers connecting between flights at the Airport. Between 2000 and 2015, the number of connecting passengers decreased an average of 0.8% per year and averaged 8.4 million during this period. The number of origin-destination passengers increased an average of 0.5% per year between 2000 and 2015, with stronger growth between 2010 and 2015 (an average increase of 1.8% per year).

In 2015, O&D passengers accounted for an estimated 53.1% of total, including 50.3% domestic O&D passengers and 2.8% international O&D passengers. Connecting passengers accounted for an estimated 46.9% of total, including 41.3% domestic connecting passengers and 5.6% international connecting passengers. Delta Air Lines accounted for 97% of all connecting passengers at the Airport in 2015, reflecting the role of the Airport as one of Delta's four primary connecting hubs and an international gateway.

Figure 3-9
PERCENT OF ORIGIN-DESTINATION AND CONNECTING PASSENGERS IN 2015
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: Calculated by subtracting connecting passengers from total enplaned passengers. Includes domestic and international O&D passengers traveling on U.S. and foreign-flag airlines as well as any passengers making connections between two international flights and non-revenue passengers.

Sources: Wayne County Airport Authority records and U.S. Department of Transportation, *Origin Destination Survey of Airline Passenger Traffic, Domestic,* online database, accessed July 2016.

Table 3-10
ORIGIN-DESTINATION AND CONNECTING PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Origin-Destination *(a)*			Connecting			Total enplaned passengers			Percent of total	
Year	Domestic	International	Total	Domestic	International	Total	Domestic	International	Total	O&D	Connecting
2000	7,941,240	603,837	8,545,077	7,510,810	1,353,350	8,864,160	15,452,050	1,957,187	17,409,237	49.1%	50.9%
2001	6,887,986	522,210	7,410,196	7,249,490	1,172,170	8,421,660	14,137,476	1,694,380	15,831,856	46.8%	53.2%
2002	6,384,421	444,324	6,828,745	7,478,430	1,174,750	8,653,180	13,862,851	1,619,074	15,481,925	44.1%	55.9%
2003	7,326,796	191,739	7,518,535	7,723,160	1,117,970	8,841,130	15,049,956	1,309,709	16,359,665	46.0%	54.0%
2004	8,037,664	190,059	8,227,723	8,147,240	1,233,150	9,380,390	16,184,904	1,423,209	17,608,113	46.7%	53.3%
2005	8,363,725	220,578	8,584,303	8,270,640	1,297,490	9,568,130	16,634,365	1,518,068	18,152,433	47.3%	52.7%
2006	8,553,685	216,294	8,769,979	7,960,500	1,245,370	9,205,870	16,514,185	1,461,664	17,975,849	48.8%	51.2%
2007	9,112,258	262,782	9,375,040	7,353,660	1,276,650	8,630,310	16,465,918	1,539,432	18,005,350	52.1%	47.9%
2008	8,960,470	261,460	9,221,930	7,017,590	1,256,350	8,273,940	15,978,060	1,517,810	17,495,870	52.7%	47.3%
2009	7,398,499	273,036	7,671,535	6,991,840	929,700	7,921,540	14,390,339	1,202,736	15,593,075	49.2%	50.8%
2010	7,720,426	373,550	8,093,976	7,156,660	954,040	8,110,700	14,877,086	1,327,590	16,204,676	49.9%	50.1%
2011	7,862,388	300,735	8,163,123	7,037,910	1,001,640	8,039,550	14,900,298	1,302,375	16,202,673	50.4%	49.6%
2012	7,856,710	326,402	8,183,112	6,851,870	1,044,050	7,895,920	14,708,580	1,370,452	16,079,032	50.9%	49.1%
2013	8,345,666	434,086	8,779,752	6,387,550	980,870	7,368,420	14,733,216	1,414,956	16,148,172	54.4%	45.6%
2014	8,046,329	398,235	8,444,564	6,738,150	1,031,020	7,769,170	14,784,479	1,429,255	16,213,734	52.1%	47.9%
2015	8,392,881	474,770	8,867,651	6,886,244	932,190	7,818,434	15,279,125	1,406,960	16,686,085	53.1%	46.9%
	Compound annual percent increase (decrease)										
2000-2005	0.9%	(3.8%)	0.8%	1.9%	(0.8%)	1.5%	1.4%	(1.3%)	1.2%		
2005-2010	(1.6)	11.1	(1.2)	(2.9)	(6.0)	(3.3)	(2.2)	(2.6)	(2.2)		
2010-2015	1.7	4.9	1.8	(0.8)	(0.5)	(0.7)	0.5	1.2	0.6		
2000-2015	0.3	3.9	0.5	(0.6)	(2.5)	(0.8)	(0.1)	(0.9)	(0.2)		

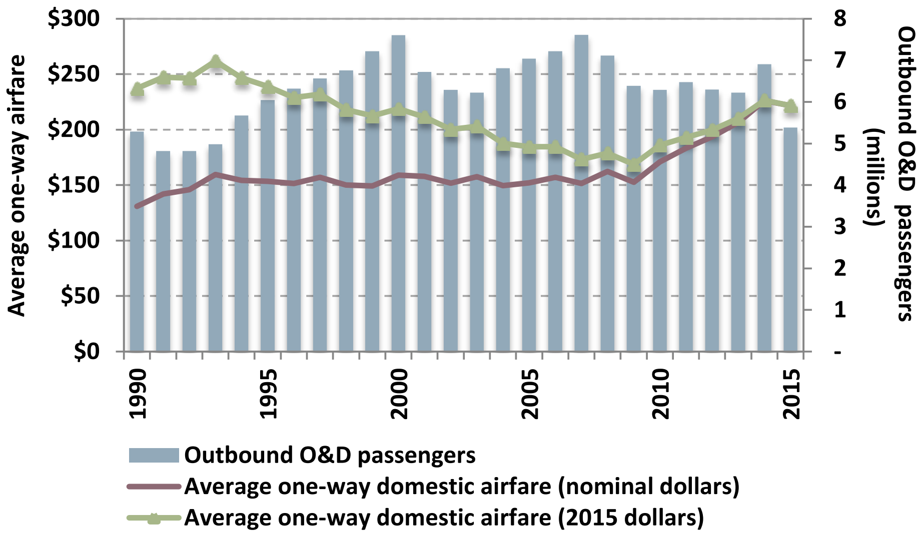
(a) Calculated by subtracting connecting passengers from total enplaned passengers. Includes domestic and international O&D passengers traveling on U.S. and foreign-flag airlines as well as any passengers making connections between two international flights and non-revenue passengers.

Source: Wayne County Airport Authority records and U.S. Department of Transportation, *Origin Destination Survey of Airline Passenger Traffic, Domestic,* online database, accessed March 2016. Data for 2015 connecting passengers are estimated based on data for January through September 2015.

3.3.4 Domestic Origin-Destination Passengers and Airfares

O&D passenger demand is affected by the demographics and economy of the region served by an airport as well as airline service and airfares. From 1990 to 2015, the number of domestic outbound O&D passengers at the Airport increased an average of 0.1% per year while nominal average domestic airfares increased (an average increase of 2.1% per year) and inflation-adjusted domestic airfares decreased slightly (an average decrease of 0.3% per year), as shown on Figure 3-10.

Figure 3-10
DOMESTIC ORIGIN-DESTINATION PASSENGERS AND AIRFARES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: U.S. Department of Transportation, *Origin-Destination Survey of Airline Passenger Traffic, Domestic*, DOT Analyser online database, accessed March 2016. The U.S. Department of Labor Consumer Price Index for All Urban Consumers was used to calculate one-way domestic airfares in 2015 dollars.

3.3.5 Airline Market Shares

The market shares for the passenger airlines serving the Airport are shown in Table 3-11 and on Figure 3-11. In 2015, Delta Air Lines had the largest market share of enplaned passengers (75.4%) at the Airport, followed by American Airlines (6.9%), Spirit (6.9%), Southwest Airlines (4.8%), United Airlines (2.9%), and jetBlue (0.7%).

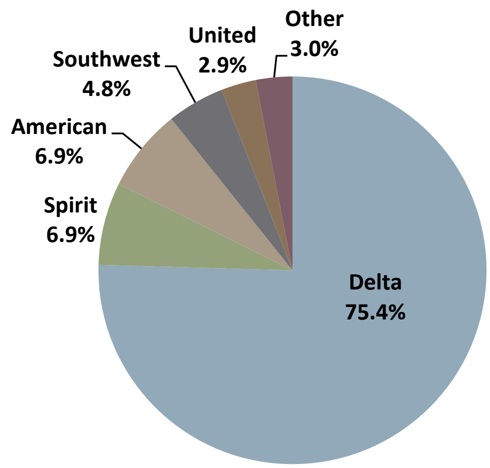
Table 3-11
AIRLINE MARKET SHARES OF ENPLANED PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
Ranked by 2015 passengers

Airline	Enplaned passengers			Percent of total		
	2010	2014	2015	2010	2014	2015
Domestic						
Delta Air Lines *(a)*	11,907,139	11,297,938	11,402,754	80.0%	76.4%	74.6%
American Airlines *(a) (b)*	973,652	1,120,039	1,156,860	6.5	7.6	7.6
Spirit Airlines	602,488	922,896	1,127,606	4.0	6.2	7.4
Southwest Airlines *(c)*	773,515	820,749	796,407	5.2	5.6	5.2
United Airlines *(a)*	480,729	407,496	487,775	3.2	2.8	3.2
jetBlue Airways	--	65,967	122,420	0.0	0.4	0.8
Frontier Airlines	126,018	106,674	101,475	0.8	0.7	0.7
Other *(d)*	13,545	42,720	83,828	0.1	0.3	0.5
Subtotal—Domestic	14,877,086	14,784,479	15,279,125	100.0%	100.0%	100.0%
International						
Delta Air Lines *(a)*	1,142,850	1,224,721	1,186,390	86.1%	85.7%	84.3%
Lufthansa	66,058	78,184	74,869	5.0	5.5	5.3
Air France	71,459	74,429	74,006	5.4	5.2	5.3
Virgin Atlantic Airways	--	--	30,823	0.0	0.0	2.2
Spirit Airlines	14,447	23,790	21,353	1.1	1.7	1.5
Royal Jordanian	15,001	14,197	12,487	1.1	1.0	0.9
Southwest Airlines *(c)*	8,078	10,223	--	0.6	0.7	0.0
Other *(e)*	17,775	13,934	7,032	1.3	1.0	0.5
Subtotal—International	1,327,590	1,429,255	1,406,960	100.0%	100.0%	100.0%
Total Airport						
Delta Air Lines *(a)*	13,049,989	12,522,659	12,589,144	80.5%	77.2%	75.4%
American Airlines *(a) (b)*	973,652	1,120,039	1,156,860	6.0	6.9	6.9
Spirit Airlines	616,935	946,686	1,148,959	3.8	5.8	6.9
Southwest Airlines *(c)*	781,593	830,972	796,407	4.8	5.1	4.8
United Airlines *(a)*	480,729	407,496	487,775	3.0	2.5	2.9
jetBlue Airways	--	65,967	122,420	0.0	0.4	0.7
Frontier Airlines	126,018	106,674	101,475	0.8	0.7	0.6
Other *(d) (e) (f)*	175,760	213,241	283,045	1.1	1.3	1.7
Total Airport	16,204,676	16,213,734	16,686,085	100.0%	100.0%	100.0%

(a) Includes regional affiliates.
(b) Includes US Airways passengers; American Airlines and US Airways merged in 2013.
(c) Merged with AirTran in 2011.
(d) Includes passengers enplaned on Alaska Airlines, Air Canada (pre-cleared and counted as domestic), and charter airlines.
(e) Includes passengers enplaned on American, Frontier, Icelandair, and charter airlines.
(f) Includes foreign-flag airlines.

Source: Wayne County Airport Authority records.

Figure 3-11
AIRLINE SHARES OF ENPLANED PASSENGERS IN 2015
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: Other includes passengers enplaned on Alaska Airlines, Air Canada (pre-cleared and counted as domestic), Frontier, jetBlue, foreign-flag, and charter airlines.

Source: Wayne County Airport Authority records.

3.3.6 Origin-Destination Markets and Airline Service

In 2015, approximately 53% of the Airport's passengers were O&D passengers; the remaining 47% were connecting passengers. This section presents a summary of the busiest domestic and international O&D markets at the Airport as well as the airline service provided to each market.

3.3.6.1 Domestic Origin-Destination Markets and Airline Service

For the 12-month period ended September 2015, the top 25 domestic passenger markets at the Airport accounted for 77.2% of total domestic O&D passengers, as shown in Table 3-12. The New York area is the largest O&D market with 6.9% of domestic O&D passengers, followed by Miami with 6.0%, Orlando (5.2%), Los Angeles (4.9%), and Las Vegas (4.8%).

In July 2016, each of the top 25 domestic passenger markets has daily nonstop service at the Airport, as shown in Table 3-12. The Airport has an average of 504 daily domestic scheduled flights in July 2016, including 269 to the top 25 domestic passenger markets. Network airlines, such as American, Delta, and United, account for 453 daily domestic scheduled departures in July 2016 (90% of total) and low cost carriers accounting for the remaining 51.

Table 3-12
DOMESTIC PASSENGER ORIGIN-DESTINATION PATTERNS AND AIRLINE SERVICE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

2015 Rank	Origin-destination market	Air miles from the Airport	Percent of domestic O&D passengers *(a)*	Average daily domestic departures in July 2016: Network	Low cost carrier	Total
1	New York *(b)*	507	6.9%	29	2	31
2	Miami *(c)*	1,147	6.0	8	3	11
3	Orlando	958	5.2	6	3	9
4	Los Angeles *(d)*	1,973	4.9	6	1	7
5	Las Vegas	1,744	4.8	5	4	9
6	Washington, D.C. *(e)*	382	4.7	21	4	25
7	Atlanta	594	3.7	10	5	15
8	Tampa	984	3.7	4	1	5
9	Chicago *(f)*	233	3.4	24	5	29
10	Denver	1,119	3.3	5	4	9
11	Dallas/Fort Worth *(g)*	985	3.2	11	2	13
12	Fort Myers	1,085	3.2	2	--	2
13	San Francisco *(h)*	2,073	3.1	5	--	5
14	Boston	630	2.9	7	4	11
15	Phoenix	1,666	2.8	7	3	10
16	Houston *(i)*	1,074	2.4	9	1	10
17	Seattle	1,921	1.9	8	--	8
18	Nashville	456	1.7	5	2	7
19	Minneapolis/St. Paul	526	1.6	8	1	9
20	San Diego	1,951	1.6	4	--	4
21	Philadelphia	452	1.3	12	1	13
22	St. Louis	439	1.2	5	2	6
23	New Orleans	926	1.2	3	1	4
24	Kansas City	626	1.2	4	1	5
25	Charlotte	500	1.2	13	--	13
	Markets listed		77.2%	221	48	269
	Other markets		22.8	232	3	235
	All markets		100.0%	453	51	504

(a) Data are for October 2014 through September 2015.
(b) LaGuardia, John F. Kennedy International, and Newark Liberty International.
(c) Miami International and Fort Lauderdale International.
(d) Los Angeles, Burbank, Long Beach, Ontario, and Orange County airports.
(e) Reagan, Dulles, and Baltimore Thurgood Marshall.
(f) O'Hare and Midway airports.
(g) Dallas/Fort Worth International Airport and Love Field.
(h) San Francisco, Oakland, and San Jose airports.
(i) George Bush Intercontinental and William P. Hobby airports.

Sources: U.S. Department of Transportation, *Origin Destination Survey of Airline Passenger Traffic, Domestic*, online database and OAG Aviation Worldwide Ltd, OAG Analyser database, accessed March 2016.

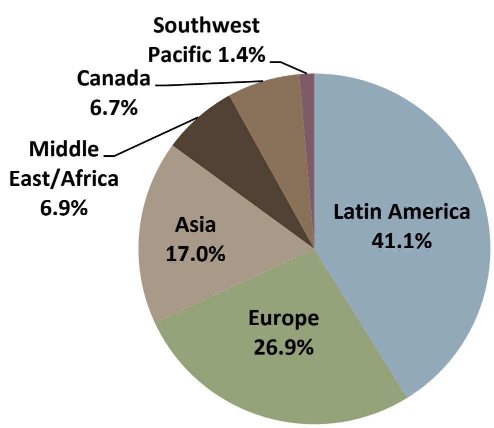
3.3.6.2 International Origin-Destination Markets and Airline Service

In 2015, the top 25 international passenger markets at the Airport accounted for 51.8% of the total international O&D passenger bookings,* as shown in Table 3-13. Cancun, Mexico is the largest O&D market with 8.7% of international O&D passenger bookings, followed by Punta Cana in the Dominican Republic with 3.6%, London, United Kingdom (3.5%), Frankfurt, Germany (3.4%), and Mexico City, Mexico (2.9%).

Of the top 25 international passenger markets, 20 had weekly nonstop service at the Airport in July 2016, as shown in Table 3-13. The Airport had an average of 241 weekly international scheduled flights in July 2016 (an average of approximately 34 daily flights), including 227 to the top 25 international passenger markets.

As shown on Figure 3-12, Latin America accounted for the largest share of the Airport passenger airline bookings in 2015, with 41.1%, followed by Europe (26.9%), Asia (17.0%), Middle East/Africa (6.9%), Canada (6.7%), and the South Pacific (1.4%).

Figure 3-12
INTERNATIONAL ORIGIN-DESTINATION PASSENGER BOOKINGS BY REGION IN 2015
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: OAG Aviation Worldwide Ltd, OAG Traffic Analyser (passenger bookings), accessed October 2014.

*As defined by the International Air Transport Association (IATA), a passenger airline "booking", equivalent to the term "reservation", means the allotment in advance of seating accommodation for a passenger. IATA, *Passenger Glossary of Terms*, www.iata.org.

Table 3-13

INTERNATIONAL PASSENGER ORIGIN-DESTINATION PATTERNS AND AIRLINE SERVICE

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

2015 Rank	Origin-destination market	Country	Nonstop miles from the Airport	Percent of international O&D bookings *(a)*	Average weekly nonstop scheduled departures *(b)*
1	Cancun	Mexico	1,475	8.7%	5
2	Punta Cana	Dominican Republic	1,854	3.6	1
3	London (*c*)	United Kingdom	3,755	3.5	14
4	Frankfurt	Germany	4,149	3.4	14
5	Mexico City (*d*)	Mexico	1,820	2.9	7
6	Montego Bay	Jamaica	1,667	2.7	1
7	Shanghai (*e*)	China	7,120	2.6	7
8	Monterrey	Mexico	1,480	2.1	7
9	Tokyo (*f*)	Japan	6,381	1.9	7
10	Toronto (*g*)	Canada	214	1.6	60
11	San Jose Cabo	Mexico	2,004	1.5	--
12	Amsterdam	Netherlands	3,927	1.5	27
13	Seoul (*h*)	Korea	6,618	1.4	7
14	Paris (*i*)	France	3,949	1.4	14
15	Montreal	Canada	529	1.3	26
16	Nassau	Bahamas	1,232	1.3	--
17	Beirut	Lebanon	5,909	1.3	--
18	Sao Paulo (*j*)	Brazil	5,105	1.3	3
19	Puerto Vallarta	Mexico	1,983	1.2	--
20	Nagoya	Japan	6,535	1.2	5
21	Aruba	Aruba	2,197	1.2	--
22	Vancouver (*k*)	Canada	1,956	1.1	1
23	Rome	Italy	4,612	1.1	7
24	Beijing	China	6,614	0.9	7
25	Munich	Germany	4,333	0.9	7
	Markets listed			51.8%	227
	Other markets			48.2	14
	All markets			100.0%	241

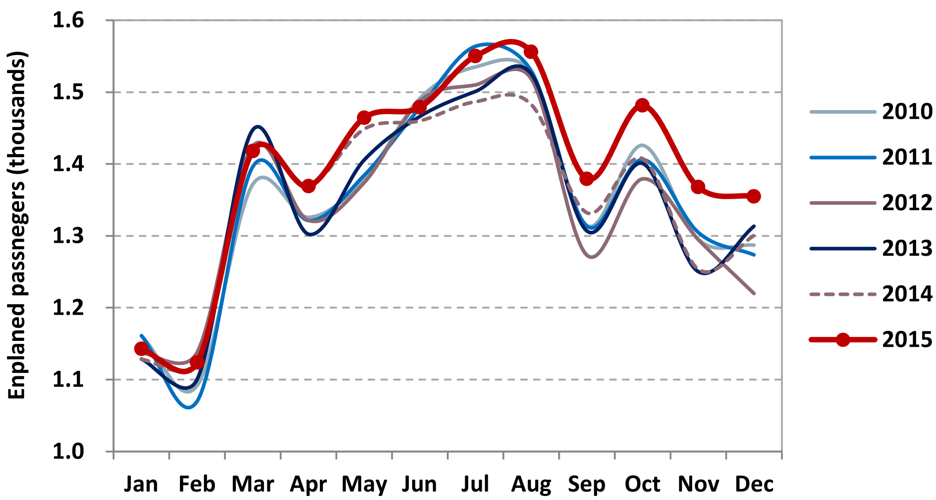
(a) Data are for calendar year 2015.
(b) Data are for July 2016.
(c) London Heathrow, London Gatwick, London City, and London Stansted airports.
(d) Mexico City Juarez International and Mexico City Toluca airports.
(e) Shanghai Pudong and Shanghai Hongqiao international airports.
(f) Tokyo Narita International and Tokyo Haneda airports.
(g) Toronto Lester B Pearson International, Toronto Kitchener/Waterloo Regional, and Toronto City Centre airports.
(h) Seoul Incheon and Seoul Gimpo international airports.
(i) Paris Charles de Gaulle and Paris Orly airports.
(j) Congonhas, Guarulhos, and Viracopos airports.
(k) Vancouver International and Coal Harbour airports.

Sources: OAG Aviation Worldwide Ltd, OAG Traffic Analyser (passenger bookings) and OAG Analyser database, accessed March 2016. Bookings data were used to represent international origin-destination patterns because the U.S. Department of Transportation, *Origin-Destination Survey of Airline Passenger Traffic, Domestic*, does not include data for foreign-flag airlines and is therefore incomplete.

3.3.7 Monthly Enplaned Passengers

Figure 3-13 presents monthly enplaned passenger data for the Airport for January 2010 through December 2015. The monthly data show the seasonal variation in enplaned passenger traffic, with peak levels occurring in July and August and the lowest monthly activity occurring from November through February.

Figure 3-13
MONTHLY ENPLANED PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: Wayne County Airport Authority records.

3.4 HISTORICAL AIR CARGO AND MAIL

Historical and future air cargo and mail activity are influenced by a number of factors including (1) the diversity of cargo airline service at an airport, (2) the cargo market shares of the airlines providing service, and (3) trends in national and international cargo traffic. This section summarizes historical trends in air cargo at the Airport. Appendix B provides a summary of historical and forecast air cargo in the Detroit Region.

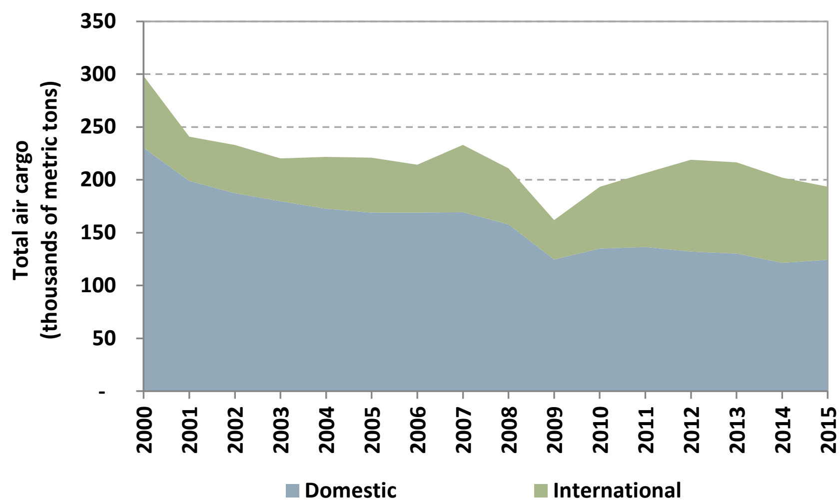
3.4.1 Airlines Providing Cargo Service at the Airport

Cargo service is provided by both the all-cargo airlines and passenger airlines serving the Airport. All-cargo airline scheduled service at the Airport is provided primarily by FedEx and United Parcel Service, both integrated cargo airlines. Non-scheduled all-cargo airline service is also provided by Atlas Air and Air Transport International. Of the 25 passenger airlines serving the Airport, 15 carried belly cargo in 2015.

3.4.2 Historical Air Cargo

As shown on Figure 3-14 and in Table 3-14, total air cargo (freight and mail) at the Airport decreased an average of 2.8% per year between 2000 and 2015. Total air cargo remained relatively unchanged between 2010 and 2015, with growth in international air cargo (an average increase of 3.4% per year) offsetting continued decreases in domestic air cargo (an average decrease of 1.6% per year). In 2015, domestic air cargo accounted for 64% of total air cargo at the Airport, down from 77% in 2000 while the percent of international air cargo increased from 23% in 2000 to 36% in 2015.

Figure 3-14
HISTORICAL AIR CARGO BY SECTOR
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: Wayne County Airport Authority records.

Table 3-14

HISTORICAL AIR CARGO BY SECTOR

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

In metric tons

	Domestic			International			Total		
Year	Air freight	Air mail	Total	Air freight	Air mail	Total	Air freight	Air mail	Total
2000	151,852	78,315	230,168	66,305	1,672	67,976	218,157	79,987	298,144
2001	139,618	59,311	198,930	40,340	1,541	41,881	179,958	60,853	240,811
2002	154,383	32,928	187,311	44,951	668	45,619	199,334	33,596	232,930
2003	155,532	24,177	179,709	40,211	327	40,538	195,742	24,504	220,246
2004	162,956	9,671	172,627	48,587	478	49,065	211,543	10,148	221,691
2005	162,213	6,732	168,945	51,279	706	51,984	213,492	7,438	220,930
2006	163,089	5,896	168,985	45,047	264	45,311	208,136	6,160	214,296
2007	164,562	4,804	169,366	62,945	723	63,668	227,507	5,528	233,035
2008	149,630	8,194	157,825	52,407	622	53,029	202,037	8,816	210,854
2009	116,327	8,206	124,533	36,733	620	37,353	153,060	8,826	161,886
2010	127,630	7,311	134,941	57,262	1,143	58,404	184,891	8,454	193,345
2011	126,735	9,676	136,411	68,354	1,661	70,015	195,089	11,337	206,426
2012	120,312	11,761	132,073	84,787	2,122	86,909	205,099	13,883	218,982
2013	117,031	13,204	130,235	82,830	3,467	86,297	199,861	16,671	216,532
2014	111,295	10,129	121,424	75,810	4,798	80,608	187,105	14,927	202,032
2015	112,585	11,723	124,308	63,881	5,262	69,143	176,466	16,985	193,451
	Percent increase (decrease)								
2010-2011	(0.7%)	32.3%	1.1%	19.4%	45.3%	19.9%	5.5%	34.1%	6.8%
2012-2013	(2.7)	12.3	(1.4)	(2.3)	63.4	(0.7)	(2.6)	20.1	(1.1)
2013-2014	(4.9)	(23.3)	(6.8)	(8.5)	38.4	(6.6)	(6.4)	(10.5)	(6.7)
2014-2015	1.2	15.7	2.4	(15.7)	9.7	(14.2)	(5.7)	13.8	(4.2)
	Compound annual percent increase (decrease)								
2000-2005	0.1%	(4.4%)	(0.6%)	(0.5%)	(1.6%)	(0.5%)	0.0%	(4.2%)	(0.5%)
2005-2010	(4.7)	1.7	(4.4)	2.2	10.1	2.4	(2.8)	2.6	(2.6)
2010-2015	(2.5)	9.9	(1.6)	2.2	35.7	3.4	(0.9)	15.0	0.0
2000-2015	(2.0)	(11.9)	(4.0)	(0.2)	7.9	0.1	(1.4)	(9.8)	(2.8)

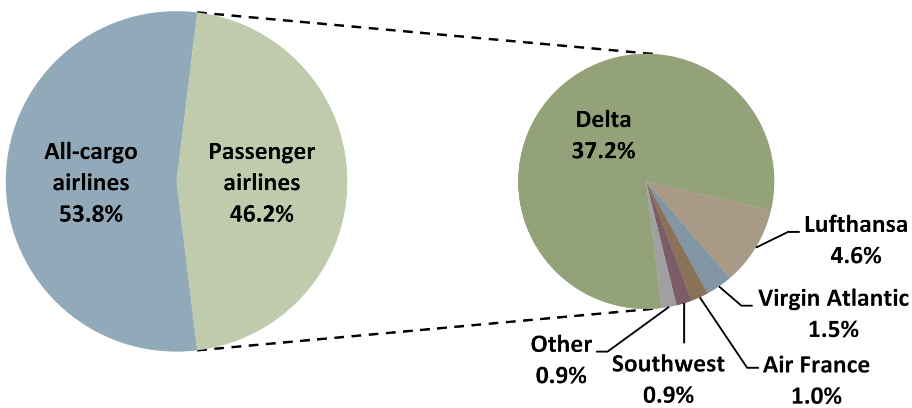
Note: Includes enplaned and deplaned air cargo.

Source: Wayne County Airport Authority records.

3.4.3 Airline Market Shares

The market shares for the passenger airlines serving the Airport are shown on Figure 3-15 and in Table 3-15. In 2015, all-cargo airlines accounted for 53.8% of total air cargo; passenger airlines accounted for the remaining 46.2%. FedEx accounted for the largest share of total air cargo in 2015, with 37.8%, followed by Delta Air Lines with 37.2%.

Figure 3-15
AIRLINE SHARES OF TOTAL AIR CARGO IN 2015
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: Wayne County Airport Authority records.

3.4.4 Air Cargo Imports and Exports

Figure 3-16 summarizes foreign trade statistics for the top 10 commodities shipped by air at the Airport in 2015 in terms of the value of imports and exports. In 2015, imports accounted for 58% of the value of imports and exports at the Airport; exports accounted for the remaining 42%.

Appendix B provides additional information on imports and exports in the Detroit Region.

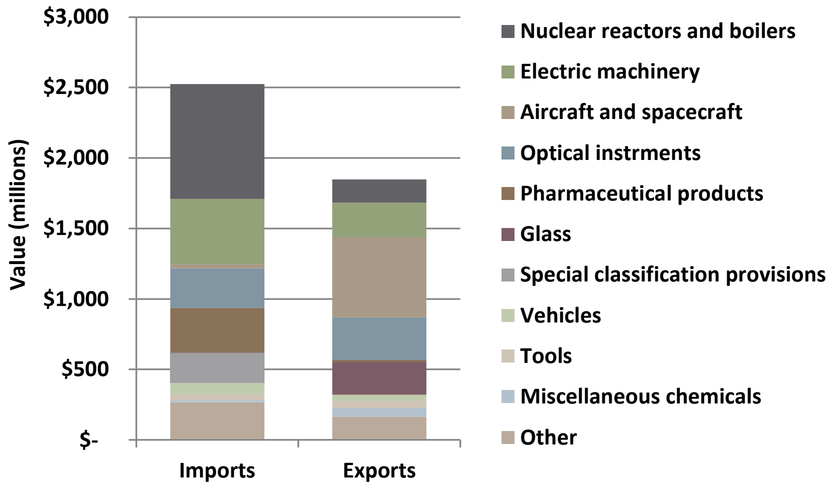
Table 3-15
AIRLINE MARKET SHARES OF TOTAL AIR CARGO
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
Ranked by 2015 total air cargo

Airline	2000	2005	2010	2015
	Total air cargo (metric tons)			
All-cargo airlines				
FedEx	64,639	97,869	85,748	73,114
United Parcel Service	34,908	31,577	28,355	27,839
Other	17,966	9,925	--	3,208
Total—all-cargo airlines	117,513	139,371	114,103	104,161
Passenger airlines				
Delta *(a)*	138,868	60,123	57,374	71,950
Lufthansa	--	--	9,221	8,979
Virgin Atlantic	--	--	-	2,982
Air France	--	1,895	6,462	1,947
Southwest	1,713	3,822	1,937	1,739
British Airways	9,435	7,220	--	--
KLM	8,416	--	--	--
Other	22,199	8,499	4,249	1,693
Total--passenger airlines	180,631	81,559	79,243	89,290
Total air cargo	298,144	220,930	193,345	193,451
	Percent of total			
All-cargo airlines				
Federal Express	21.7%	44.3%	44.3%	37.8%
United Parcel Service	11.7	14.3	14.7	14.4
Other	6.0	4.5	0.0	1.7
Total—all-cargo airlines	39.4%	63.1%	59.0%	53.8%
Passenger airlines				
Delta *(a)*	46.6%	27.2%	29.7%	37.2%
Lufthansa	0.0	0.0	4.8	4.6
Virgin Atlantic	0.0	0.0	0.0	1.5
Air France	0.0	0.9	3.3	1.0
Southwest	0.6	1.7	1.0	0.9
British Airways	3.2	3.3	0.0	0.0
KLM	2.8	0.0	0.0	0.0
Other	7.4	3.8	2.2	0.9
Total--passenger airlines	60.6%	36.9%	41.0%	46.2%
Total air cargo	100.0%	100.0%	100.0%	100.0%

(a) Includes regional affiliates.

Source: Wayne County Airport Authority records.

Figure 3-16
AIR CARGO IMPORTS AND EXPORTS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

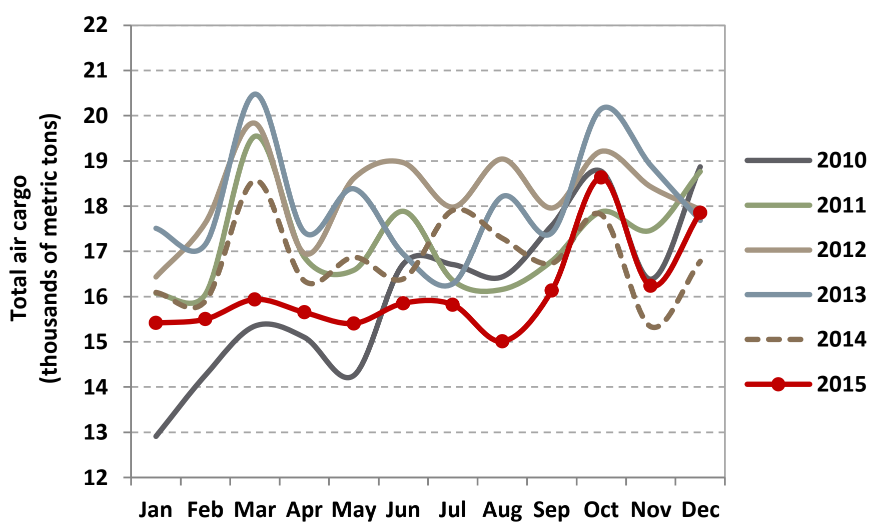


Source: U.S. Census Bureau, Economic Indicators Division, Foreign Trade Statistics, www.census.gov/foreign-trade, accessed February 2015.

3.4.5 Monthly Air Cargo

Figure 3-17 presents monthly air cargo data for the Airport for January 2010 through December 2015. The monthly data show the seasonal variation in total air cargo, which is not as consistent as the monthly trends in enplaned passengers. Except for 2010 and 2015, the peak levels tend to occur in March and October.

Figure 3-17
MONTHLY TOTAL AIR CARGO
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: Wayne County Airport Authority records.

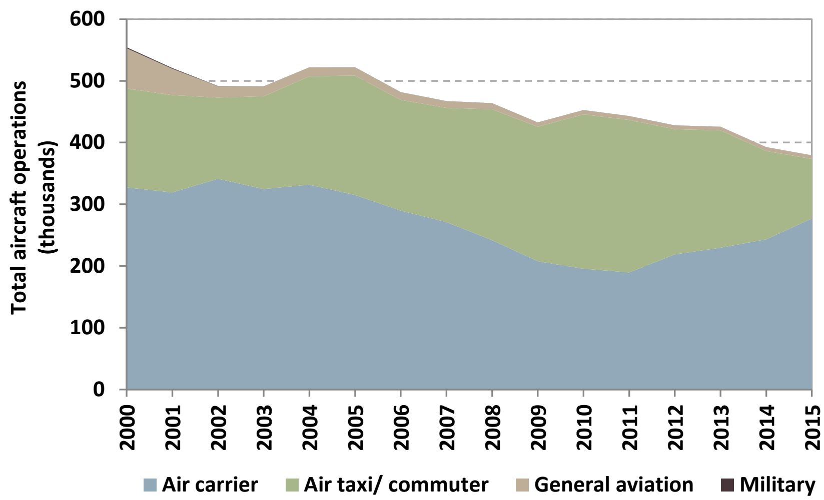
3.5 HISTORICAL AIRCRAFT OPERATIONS

This section summarizes historical total aircraft operations at the Airport from 2000 through 2015. Aircraft operations include the total number of departures and arrivals by air carrier, air taxi and commuter, general aviation, and military aircraft. An aircraft operation is defined as either a takeoff or a landing at the Airport. Figure 3-18 and Table 3-16 present a summary of total aircraft operations at the Airport by type.

3.5.1 Total Aircraft Operations

From 2000 to 2015, the number of total aircraft operations at the Airport decreased an average of 2.5% per year, reflecting increased load factors, the densification of aircraft (i.e., putting more seats on existing aircraft), and overall reductions in airline system capacity as a result of the spike in fuel prices in 2008, and the 2008-2009 economic recession and financial crisis.

Figure 3-18
HISTORICAL AIRCRAFT OPERATIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: Federal Aviation Administration, Air Traffic Activity System (ATADS), www.faa.gov, accessed January 2016.

Table 3-16
HISTORICAL AIRCRAFT OPERATIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Commercial operations						
Year	Air carrier	Air taxi/ commuter	Total	General aviation	Military	Total aircraft operations	Percent increase (decrease)
2000	327,207	160,313	487,520	65,303	1,586	554,409	(0.9%)
2001	319,118	157,689	476,807	42,771	1,138	520,716	(6.1)
2002	341,244	131,586	472,830	18,477	290	491,597	(5.6)
2003	324,615	150,391	475,006	15,902	211	491,119	(0.1)
2004	331,629	175,694	507,323	14,435	150	521,908	6.3
2005	315,031	193,480	508,511	13,180	208	521,899	0.0
2006	289,637	179,458	469,095	12,539	106	481,740	(7.7)
2007	271,034	185,105	456,139	11,000	95	467,234	(3.0)
2008	241,757	212,129	453,886	9,733	165	463,784	(0.7)
2009	207,711	217,873	425,584	6,876	129	432,589	(6.7)
2010	195,506	250,145	445,651	6,849	116	452,616	4.6
2011	189,493	247,041	436,534	6,363	131	443,028	(2.1)
2012	218,736	202,822	421,558	6,033	223	427,814	(3.4)
2013	229,560	190,178	419,738	5,930	64	425,732	(0.5)
2014	243,117	143,122	386,239	6,264	132	392,635	(7.8)
2015	276,898	96,533	373,431	5,843	102	379,376	(3.4)
	Compound annual percent increase (decrease)						
2000-2005	(0.8%)	3.8%	0.8%	(27.4%)	(33.4%)	(1.2%)	
2005-2010	(9.1)	5.3	(2.6)	(12.3)	(11.0)	(2.8)	
2010-2015	7.2	(17.3)	(3.5)	(3.1)	(2.5)	(3.5)	
2000-2015	(1.1)	(3.3)	(1.8)	(14.9)	(16.7)	(2.5)	

Note: Includes arrivals and departures.

Source: Federal Aviation Administration, Air Traffic Activity System (ATADS), www.faa.gov, accessed January 2016.

3.5.2 Air Carrier

Air carrier operations are those performed in revenue service by the passenger and all-cargo airlines serving the Airport. Included are scheduled flights, charter flights, diverted flights, and ferry operations (empty flights). The FAA defines an air carrier aircraft, for traffic counting purposes, as capable of carrying more than 60 passengers and provides a list of model types that are counted as air carrier operations (Appendix 3 in Order JO 7210.3Z), even if the aircraft is conducting air freight operations.* As shown in Table 3-16, air carrier aircraft operations decreased an average of 1.1% per year between 2000 and 2015. Between 2000 and 2005, air carrier operations decreased an average of 9.1% per year, reflecting increases in average passenger load factors and the increasing use of 50-seat regional aircraft in markets previously served with narrowbody aircraft. Since 2010, the number of air carrier operations has increased—an average of 7.2% per year between 2010 and 2015, reflecting, in part, the fuel price spike in 2008 that led to the replacement of 50-seat regional jets with regional jets with more than 60 seats (classified as air carrier operations).

3.5.3 Air Taxi and Commuter

Air taxi and commuter operations consist of unscheduled operations of "for hire" air taxis and the scheduled operations of commuter airlines, including regional affiliate airlines operating aircraft with less than 60 seats. The FAA defines air taxi and commuter operations as those performed by aircraft other than those listed above and which use three-letter company designators. Fractional ownership and management companies and corporate flight departments that use a three-letter company designator are included in air taxi operations. As shown in Table 3-16, air taxi and commuter aircraft operations increased between 2000 and 2010. Since 2010, air taxi and commuter operations have decreased significantly—an average decrease of 17.3% per year between 2010 and 2015, reflecting the increased use of larger regional aircraft, increasing fuel costs, and the comparatively higher cost of operating small regional jet aircraft. In 2015, passenger and cargo airlines accounted for approximately 98% of air taxi and commuter operations at the Airport; nonscheduled air taxi and business aviation accounted for the remaining 2%.

3.5.4 General Aviation

General aviation operations include all civil aircraft operations not classified as air carrier or air taxi and commuter operations. As shown in Table 3-16, general aviation aircraft operations decreased an average of 14.9% per year between 2000 and 2015. According to the FAA 2015 TAF, a total of seven jet engine general aviation aircraft were based at the Airport in 2015.

3.5.5 Military

Military aircraft operations at the Airport have averaged approximately 300 operations per year from 2000 through 2015. In 2015, military operations totaled 102, less than the 16-year average. Historically, military operations have varied with geopolitical trends.

3.5.6 Monthly Aircraft Operations

Figure 3-19 presents monthly total aircraft operations data for the Airport for January 2010 through December 2015. The monthly data show the seasonal variation in total aircraft operations, with July and August each accounting for 9.0% and 8.9%, respectively, of annual operations in 2015. From 2010 through 2015, July and August accounted for the peak share of annual aircraft operations at the Airport, with an average of approximately 9% of annual operations.

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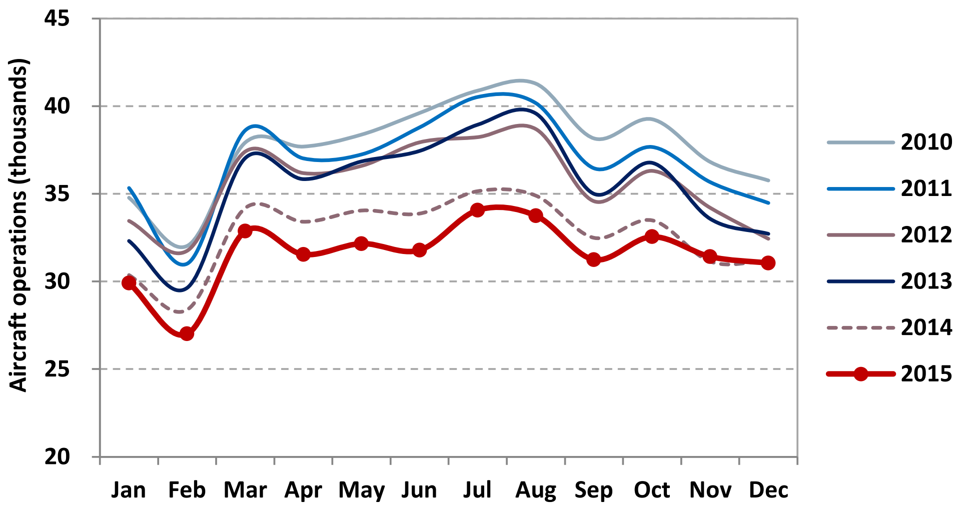
*U.S. Department of Transportation, Federal Aviation Administration, Order JO 7210.3Z, November 10, 2015, http://www.faa.gov/air_traffic/publications.

Figure 3-19
MONTHLY AIRCRAFT OPERATIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: Federal Aviation Administration, Air Traffic Activity System (ATADS), www.faa.gov, accessed January 2016.

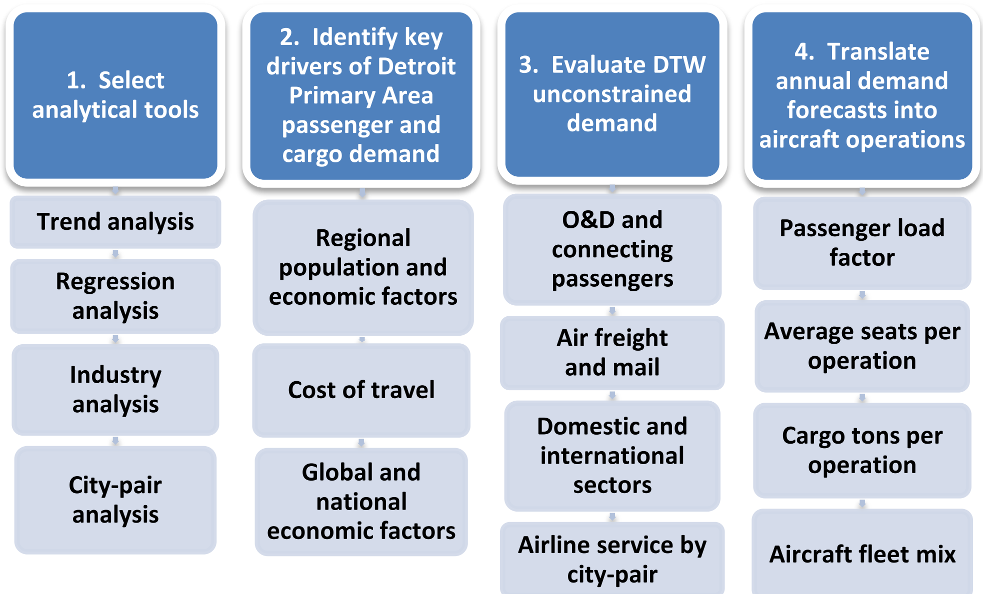
3.6 AVIATION ACTIVITY FORECASTS

This section summarizes unconstrained forecasts of enplaned passengers, air cargo, and total aircraft operations for the Airport, including the forecast approach, methodology, and assumptions. As noted earlier, the baseline forecasts presented in this report are "unconstrained" and, therefore, do not include specific assumptions about physical, regulatory, environmental or other impediments to aviation activity growth. Forecasts of aviation activity are presented for enplaned passengers, air cargo, and aircraft operations, including passenger, all-cargo, general aviation, and military operations. Using calendar year 2015 as the base year, annual forecasts were prepared for four future demand years—2020, 2025, 2030, and 2035.

3.6.1 Forecast Approach

As shown on Figure 3-20, the forecast approach incorporated a multi-tiered approach to evaluate passenger traffic in the Detroit Primary Area.

Figure 3-20
FORECAST APPROACH
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Authority records (based on data reported by the airlines) were used as the basis for the enplaned passenger (revenue and non-revenue), air cargo, and commercial airline aircraft operations forecasts. Data from the U.S. Department of Transportation O&D Survey was used as a basis for the evaluation of O&D and connecting passengers. FAA, Air Traffic Activity System (ATADS) data were used as the basis for the total aircraft operations forecasts.

It was recognized that no one approach would provide input on all of the key factors that affect passenger and cargo activity in the Detroit Primary Area. For example, an econometric analysis would provide input on the relationships between historical passengers and regional economic conditions but little to no input on such factors as (1) the role of individual markets in airline scheduling and service decisions, (2) recent trends in the airline industry that have affected an airline's decisions in route planning and aircraft acquisition, and (3) new service development at the Airport. Input on these factors is important to the development of reliable forecasts that can serve as the basis for planning efforts at the Airport.

3.6.2 Enplaned Passenger Forecasts

Domestic O&D passengers accounted for 50.3% of enplaned passengers at the Airport in 2015, followed by domestic connecting passengers with 41.0%, international O&D (2.8%), and international connecting passengers using the Airport as their international gateway (5.9%). The forecast approach and results for these four key components of passenger demand at the Airport are described in the following sections.

3.6.2.1 Domestic Origin-Destination Passengers

The forecasts of domestic O&D passengers at the Airport are based on an econometric model relating passenger trends to economic and airline industry metrics. Typically, a passenger regression model includes an income variable (e.g., total personal income, per capita income, or GDP—all expressed in constant dollars) and a cost of travel variable (e.g., yield or airfare—also expressed in constant dollars). The primary objective is to represent the two key variables that affect air travel demand (i.e., how much people have to spend and how much it costs to travel). Other variables may be important as well, depending on the traffic market characteristics.

As shown on Figure 3-21, the historical trend in domestic O&D passengers at the Airport relates strongly to regional economic activity. Single variable regression models, which included economic variables such as total income, per capita personal income, or employment in the Detroit Primary Area explained as much as 80% of the historical variation (i.e., the year to year percent change) in domestic O&D passengers.

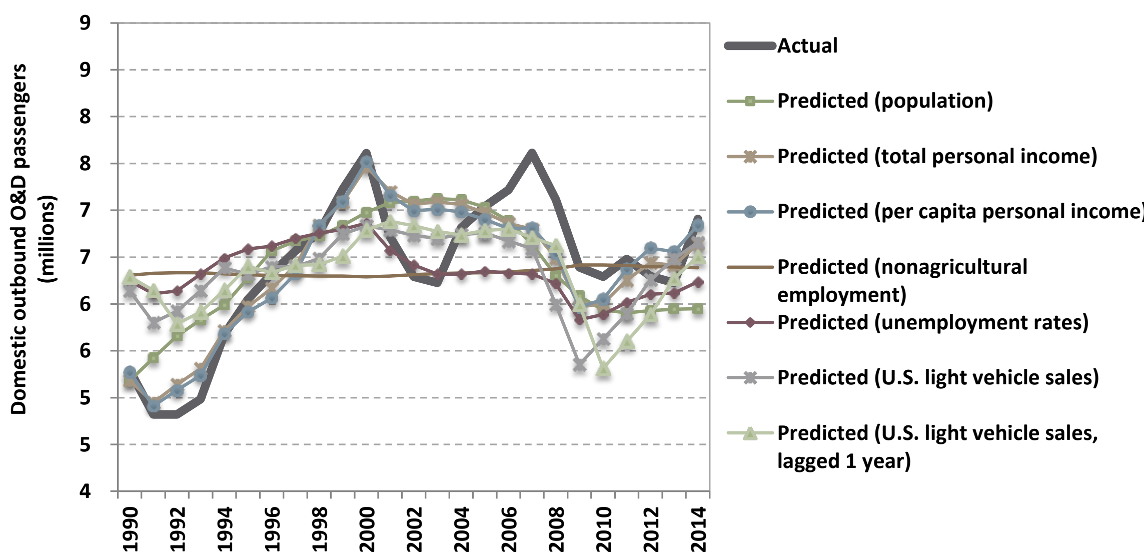
Figure 3-21

ECONOMIC DRIVERS

ACTUAL AND PREDICTED DOMESTIC ORIGIN-DESTINATION PASSENGERS

Airport Master Plan Update

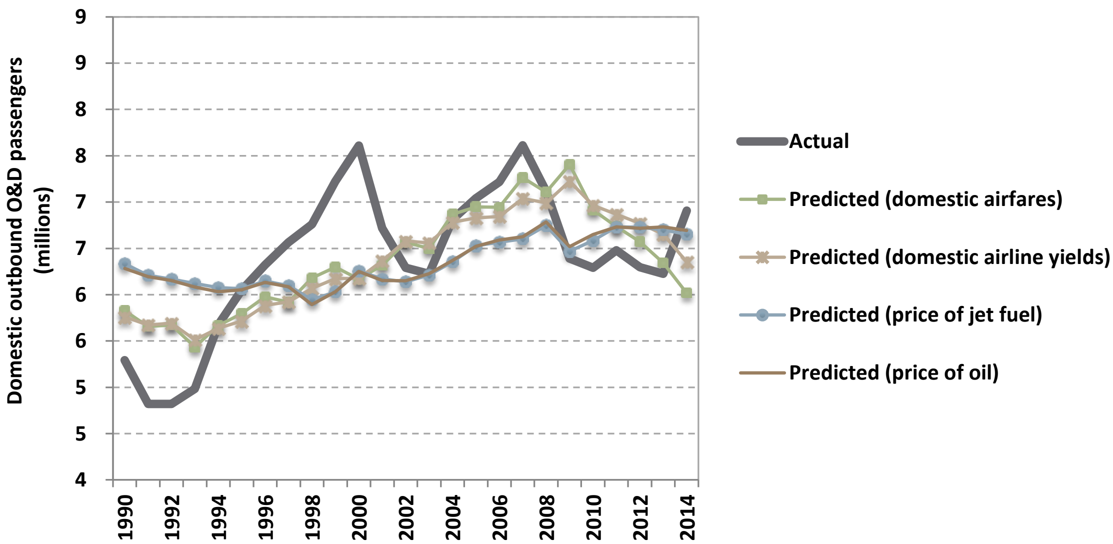
Detroit Metropolitan Wayne County Airport



Sources: Actual—U.S. Department of Transportation, *Origin-Destination Survey of Airline Passenger Traffic, Domestic,* online database, accessed January 2016.
Predicted regression model results—LeighFisher, March 2016.

Figure 3-22 presents single variable regression models which included cost of travel variables such as airfare and airline yield (i.e., the airfare paid to transport one passenger one mile) at the Airport or the price of jet fuel and oil explained as much as 40% of the historical variation in domestic O&D passengers.

Figure 3-22
COST OF TRAVEL DRIVERS
ACTUAL AND PREDICTED DOMESTIC ORIGIN-DESTINATION PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

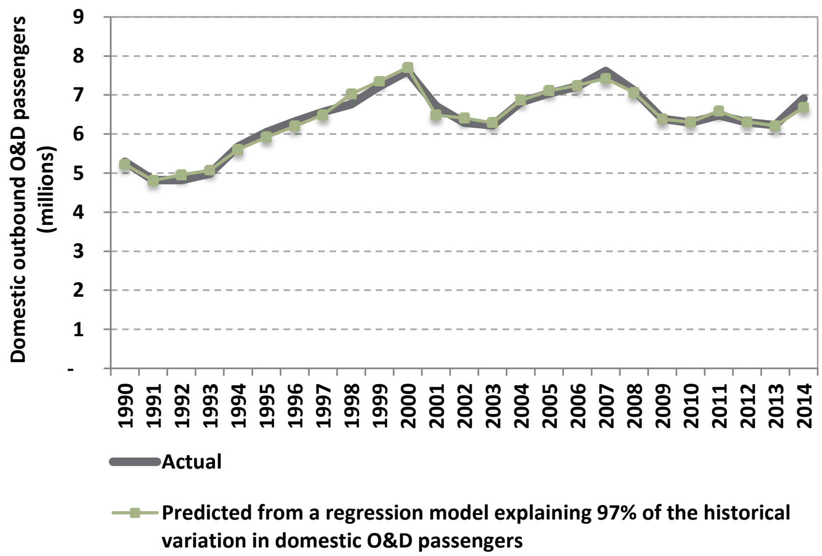


Sources: Actual—U.S. Department of Transportation, *Origin-Destination Survey of Airline Passenger Traffic, Domestic,* online database, accessed January 2016.
Predicted regression model results —LeighFisher, March 2016.

A representative regression model, which includes an income variable and a cost of travel variable, is shown on Figure 3-23. The historical trend in domestic O&D passengers at the Airport relates strongly to the predicted values from a regression model which includes per capita income in the Detroit Primary Area (in 2014 dollars), unemployment rates in the Detroit Primary Area, and airline yields at the Airport (in 2014 dollars). The forecasts of domestic O&D passengers at the Airport were based on projections of per capita income in the Detroit Primary Area prepared by SEMCOG, presented in Table 3-3, and projections of the Airport airline yields and airfares based on the growth rates in the FAA's national forecasts of airline yield.* Independent forecasts of unemployment rates in the Detroit Primary Area were not available; it was assumed that unemployment rates would stabilize but remain above U.S. unemployment rates, consistent with historical trends. Appendix A provides a summary of the predictive model used as the basis for the forecasts of domestic O&D passengers.

*Federal Aviation Administration, *FAA Aerospace Forecasts, Fiscal Years 2016-2036*, March 2016, www.faa.gov.

Figure 3-23
REPRESENTATIVE MODEL
ACTUAL AND PREDICTED DOMESTIC ORIGIN-DESTINATION PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: Actual—U.S. Department of Transportation, *Origin-Destination Survey of Airline Passenger Traffic, Domestic,* online database, accessed January 2016.
Predicted regression model results —LeighFisher, March 2016.

Domestic O&D passengers at the Airport are forecast to increase an average of 2.0% per year between 2015 and 2035, with faster growth in the near-term—an average increase of 2.5% between 2015 and 2020, as shown in Table 3-17. The percent of domestic O&D passengers at the Airport is forecast to increase from 50.3% in 2015 to 57.4% in 2035, reflecting the forecasts of economic growth for the Detroit Primary Area.

3.6.2.2 Domestic Connecting Passengers

The success and development of an airline connecting hub airport is based on a number of factors, including:

- The number of the O&D passengers in the region served by an airport which help to maintain load factors and support connecting banks of flights.
- The geographical location of a hub in relation to population centers and other hubs in an airline's network.
- The mix of domestic and international operations at an airport and the potential for airlines to provide service to high yield business and international markets.
- The cost of airline operations at an airport.

Table 3-17

HISTORICAL AND FORECAST ORIGIN-DESTINATION AND CONNECTING ENPLANED PASSENGERS

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

	Historical		Forecast			
	2014	2015	2020	2025	2030	2035
Domestic						
Origin-destination	8,046,329	8,388,644	9,468,600	10,422,900	11,356,000	12,420,500
Connecting	6,738,150	6,886,244	7,060,100	7,238,400	7,421,200	7,514,400
Domestic total	14,784,479	15,274,888	16,528,700	17,661,300	18,777,200	19,934,900
International						
Origin-destination	398,235	474,177	536,600	593,000	646,100	706,700
Connecting	1,031,020	932,190	953,700	975,800	998,500	1,010,300
International total	1,429,255	1,406,367	1,490,300	1,568,800	1,644,600	1,717,000
Airport Total						
Origin-destination	8,444,564	8,862,821	10,005,200	11,015,900	12,002,100	13,127,200
Connecting	7,769,170	7,818,434	8,013,800	8,214,200	8,419,700	8,524,700
Airport total	16,213,734	16,681,255	18,019,000	19,230,100	20,421,800	21,651,900
	Percent of total					
Domestic						
Origin-destination	49.6%	50.3%	52.5%	54.2%	55.6%	57.4%
Connecting	41.6	41.3	39.2	37.6	36.3	34.7
Domestic total	91.2%	91.6%	91.7%	91.8%	91.9%	92.1%
International						
Origin-destination	2.5%	2.8%	3.0%	3.1%	3.2%	3.3%
Connecting	6.4	5.6	5.3	5.1	4.9	4.7
International total	8.8%	8.4%	8.3%	8.2%	8.1%	7.9%
Airport Total						
Origin-destination	52.1%	53.1%	55.5%	57.3%	58.8%	60.6%
Connecting	47.9	46.9	44.5	42.7	41.2	39.4
Airport total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Compound annual percent change					
		2015-2020	2020-2025	2025-2030	2030-2035	2015-2035
Domestic						
Origin-destination		2.5%	1.9%	1.7%	1.8%	2.0%
Connecting		0.5	0.5	0.5	0.2	0.4
Domestic total		1.6	1.3	1.2	1.2	1.3
International						
Origin-destination		2.5	2.0	1.7	1.8	2.0
Connecting		0.5	0.5	0.5	0.2	0.4
International total		1.2	1.0	0.9	0.9	1.0
Airport Total						
Origin-destination		2.5	1.9	1.7	1.8	2.0
Connecting		0.5	0.5	0.5	0.2	0.4
Airport total		1.6	1.3	1.2	1.2	1.3

Notes: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Totals may not add due to rounding.

Sources: Historical—Wayne County Airport Authority records and U.S. Department of Transportation.
Forecast—LeighFisher, March 2016.

The Airport is a mature airline connecting hub, with hub operations started by Republic Airlines in 1984, expanded in 1986 with the merger of Republic and Northwest Airlines, and continued since 2008 with the merger of Northwest and Delta Air Lines. In 2015, Delta accounted for approximately 97% of passengers connecting at the Airport. The Airport handled 7.8 million connecting passengers in 2015, similar to that for Delta's connecting hubs at Minneapolis (8.1 million) and Los Angeles (8.0 million). The forecasts of domestic connecting passengers at the Airport are based on:

- Input from interviews with network planners at Delta Air Lines regarding the continued role of the Airport as a primary connecting hub in Delta's system.
- An analysis of the historical trends in connecting passengers at the Airport and at Delta's other connecting hubs.
- A large population and O&D passenger base to support connecting hub operations.
- Professional judgement based on similar analyses for other U.S. connecting hub airports.

From 2000 to 2016, Delta's hub at the Airport has been the second or third busiest in its system in terms of scheduled departing seats. Although the Airport is approximately 500 miles from Delta's hub at Minneapolis/St. Paul, the Airport is the third busiest in the airline's network in 2015 (after Minneapolis/St. Paul) and serves a population base of 5.3 million. In comparison, Delta's hub at Minneapolis/St. Paul serves a population base of 3.9 million.

Domestic connecting passengers at the Airport are forecast to increase an average of 0.4% per year between 2015 and 2035, with slightly faster growth in the near-term—an average increase of 0.5% between 2015 and 2020, as shown in Table 3-17. The percent of domestic connecting passengers at the Airport is forecast to decrease from 41.3% in 2015 to 34.7% in 2035, reflecting faster forecast growth in domestic origin-destination passengers (an average increase of 2.0% per year between 2015 and 2035).

3.6.2.3 International Origin-Destination Passengers

The number of international O&D passengers at the Airport is related to the strength of the Detroit Primary Area economy and the location of global companies and strong international communities of interest in the Detroit Primary Area. In addition, the level of international service provided at the Airport is supported by the role of the Airport as a primary connecting hub and international gateway in Delta's system. The forecasts of international O&D passengers are based on:

- An analysis of the Airport international passengers by airline and city-pair market.
- Input from interviews with network planners at Delta Air Lines regarding the potential for additional international nonstop service at the Airport.
- Socioeconomic forecasts presented in Table 3-3.
- A review of industry forecasts of passenger traffic growth by international region prepared by Airbus, The Boeing Corporation, and the FAA, as shown in Table 3-18.
- Professional judgement based on similar analyses for other U.S. international gateway airports.

It is important to note that U.S. Department of Transportation (DOT) data for the Airport international O&D passengers do not include foreign-flag airline activity and are incomplete. Therefore, there is no reliable historical data series of international O&D passenger data to use in developing a regression model. As a result of the incomplete data series, international O&D passengers for the Airport are derived by subtracting U.S. DOT data for international connecting passengers from the Airport international enplaned passengers.

Table 3-18
COMPARATIVE INDUSTRY FORECASTS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

International region	Compound annual growth rate: 2014-2034		
	Airbus	Boeing	FAA
Asia/Pacific	5.7%	6.1%	3.8%
Europe	3.6	3.8	3.7
North America	2.5	3.1	2.2
Middle East	6.7	6.2	--
Latin America and Caribbean	5.5	6.0	4.0
Commonwealth of Independent States	4.9	3.7	--
Africa	5.3	5.7	--
Rest of world	--	7.8	--
World	4.6	4.9	3.8

Note: Market categories differ for each industry forecast.
Airbus and Boeing forecasts are for revenue passenger kilometers.
FAA forecasts are for total passenger traffic to and from the United States by U.S. and foreign-flag airlines.

Sources: Airbus, Global Market Forecast, 2015-2034, 2015, www.airbus.com.
The Boeing Corporation, Current Market Outlook, 2015-2034, 2015, www.boeing.com.
U.S. Department of Transportation, FAA Aerospace Forecast, Fiscal Years 2015-2040, March 2016, www.faa.gov.

As shown in Table 3-17, international O&D passengers at the Airport are forecast to increase an average of 2.0% per year between 2015 and 2035, with faster growth in the near-term—an average increase of 2.5% between 2015 and 2020. The percent of international O&D passengers at the Airport is forecast to increase from 2.8% in 2015 to 3.3% in 2035, reflecting the continued expansion of international service and growth in the numbers of international passengers.

3.6.2.4 International Connecting Passengers

The number of international connecting passengers at the Airport is related to the role of the Airport as an airline connecting hub in Delta's system and the development of the Airport as an international gateway by Delta and foreign-flag airlines. The forecast of international connecting passengers is based on:

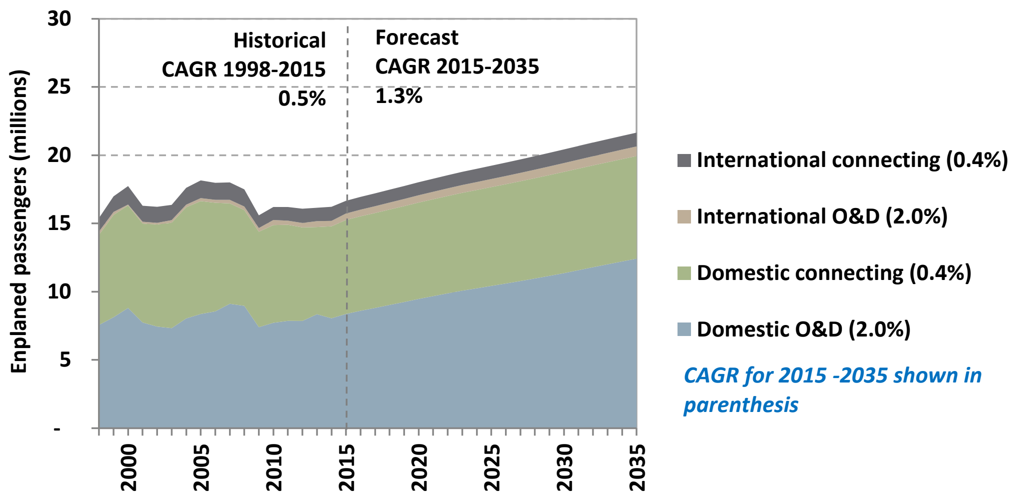
- Input from interviews with network planners at Delta Air Lines regarding the continued role of the Airport as a primary connecting hub and international gateway in Delta's system.
- An analysis of the historical trends in connecting passengers at the Airport and at Delta's other connecting hubs.
- Professional judgement based on similar analyses for other U.S. connecting hub airports.

As shown in Table 3-17, international connecting passengers at the Airport are forecast to increase an average of 0.4% per year between 2015 and 2035, with faster growth in the near-term—an average increase of 0.4% between 2015 and 2020. Similar to the trend in domestic connecting passengers, the percent of international connecting passengers at the Airport is forecast to decrease from 5.6% in 2015 to 4.7% in 2035, reflecting faster forecast growth in International origin-destination passengers (an average increase of 2.0% per year between 2015 and 2035).

3.6.2.5 Total Enplaned Passengers

As shown on Figure 3-24 and in Table 3-19, the number of total enplaned passengers at the Airport is forecast to increase from 16.7 million passengers in 2015 to 21.7 million in 2035, increasing an average of 1.3% per year. The number of domestic passengers is forecast to increase an average of 1.3% per year between 2015 and 2035, compared with an average increase of 1.0% in international passenger traffic.

Figure 3-24
HISTORICAL AND FORECAST ENPLANED PASSENGERS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

CAGR = Compound annual growth rate

Source: Historical—Wayne County Airport Authority records.
Forecast—LeighFisher, March 2016.

As shown in Table 3-19, the McNamara Terminal accounted for 12.7 million enplaned passengers at the Airport in 2015 (76% of total) and is forecast to account for 16.5 million in 2035. The number of domestic passengers at the Airport is forecast to increase an average of 1.3% per year between 2015 and 2035, compared with an average increase of 1.0% in international passenger traffic.

Table 3-19
HISTORICAL AND FORECAST ENPLANED PASSENGERS BY TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Historical		Forecast			
	2014	2015	2020	2025	2030	2035
McNamara Terminal						
Domestic						
Delta Air Lines						
Network	6,911,702	7,406,571	8,014,500	8,563,700	9,104,800	9,666,200
Regional affiliates	4,386,236	3,996,183	4,324,200	4,620,600	4,912,500	5,215,300
Subtotal--Domestic	11,297,938	11,402,754	12,338,700	13,184,300	14,017,300	14,881,500
International	1,299,150	1,291,219	1,368,300	1,440,400	1,509,900	1,576,400
McNamara Terminal total	12,597,088	12,693,973	13,707,000	14,624,700	15,527,200	16,457,900
North Terminal						
Domestic						
Airlines other than Delta Air Lines						
Network *(a)*	837,308	923,566	999,400	1,067,900	1,135,300	1,205,300
Regional affiliates *(b)*	732,947	800,660	866,400	925,800	984,200	1,044,900
Low cost carriers	1,916,286	2,147,908	2,324,200	2,483,500	2,640,400	2,803,200
Subtotal--Domestic	3,486,541	3,872,134	4,190,000	4,477,200	4,759,900	5,053,400
International	130,105	115,148	122,000	128,600	134,700	140,600
North Terminal total	3,616,646	3,987,282	4,312,000	4,605,800	4,894,600	5,194,000
Total Airport						
McNamara Terminal	12,597,088	12,693,973	13,707,000	14,624,700	15,527,200	16,457,900
North Terminal	3,616,646	3,987,282	4,312,000	4,605,800	4,894,600	5,194,000
Total Airport	16,213,734	16,681,255	18,019,000	19,230,500	20,421,800	21,651,900

	Compound annual percent change				
	2015-2020	2020-2025	2025-2030	2030-2035	2015-2035
McNamara Terminal					
Domestic					
Delta Air Lines					
Network	1.6%	1.3%	1.2%	1.2%	1.3%
Regional affiliates	1.6	1.3	1.2	1.2	1.3
Subtotal--Domestic	1.6	1.3	1.2	1.2	1.3
International	1.2	1.0	0.9	0.9	1.0
McNamara Terminal Total	1.5	1.3	1.2	1.2	1.3
North Terminal					
Domestic					
Airlines other than Delta Air Lines					
Network *(a)*	1.6	1.3	1.2	1.2	1.3
Regional affiliates *(b)*	1.6	1.3	1.2	1.2	1.3
Low cost carriers	1.6	1.3	1.2	1.2	1.3
Subtotal--Domestic	1.6	1.3	1.2	1.2	1.3
International	1.2	1.1	0.9	0.9	1.0
North Terminal total	1.6	1.3	1.2	1.2	1.3
Total Airport	1.6	1.3	1.2	1.2	1.3

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.
Totals may not add due to rounding.

Sources: Historical—Wayne County Airport Authority records and U.S. Department of Transportation.
Forecast—LeighFisher, March 2016.

3.6.2.6 Enplaned Passenger Forecast Assumptions

Forecasts of enplaned passengers were developed taking into account analyses of the economic basis for airline traffic, analyses of historical airline traffic, and an assessment of the key factors that may affect future airline traffic. In general, it was assumed that, in the long term, changes in airline traffic at the Airport will occur largely as a function of growth in the population and economy of the Detroit Primary Area and changes in airline service. It was also assumed that continued development of airline service at the Airport will not be constrained by the availability of aviation fuel, long-term limitations in airline fleet capacity, limitations in the capacity of the air traffic control system or the Airport, or government policies or actions that restrict growth. Also considered were recent and potential developments in the national economy and in the air transportation industry as they have affected or may affect airline traffic at the Airport.

For 2016 through FY 2035, it was assumed that:

- The U.S. economy will increase an average of 2.0% to 2.5% per year during the forecast period (see Table 3-3).
- The economy of the Detroit Primary Area (as measured by employment and per capita income) will increase at slower rates compared with the U.S. as a whole (see Table 3-3).
- The Airport will continue to be the primary commercial service airport for the Detroit Primary Area, the primary connecting hub and international gateway for Delta Air Lines.
- A generally stable international political environment and enhanced passenger and baggage screening procedures will maintain airline traveler confidence in aviation security without imposing unreasonable inconvenience.
- There will be no material disruption of airline service or passenger travel behavior as a result of international hostilities, terrorist acts or threats, or global safety or health concerns.
- Aviation fuel prices will stabilize at levels that are historically high, but lower than the record prices reached in mid-2008.
- Competition among the airlines serving the Airport will ensure the continued availability of competitive airfares.

3.6.3 Air Cargo Forecasts

Domestic air cargo accounted for 64.3% of total air cargo at the Airport in 2015; international air cargo accounted for the remaining 35.7%. As mentioned earlier, the analysis and forecasts of air cargo for the Airport were based on an analysis of air cargo for the Detroit Region, as summarized in Appendix B. The forecast results for the domestic and international components of air cargo demand at the Airport are described in the following sections.

3.6.3.1 Domestic Air Cargo

Since 2000, domestic air cargo at the Airport and in the nation as a whole* has decreased—an average decrease of 4.0% and 1.0% per year, respectively, between 2000 and 2015, reflecting, in part, increases in air cargo shipping costs related to increased oil prices and the availability of less expensive alternative shipping modes.

*In terms of revenue tons miles as reported by the FAA.

The preparation of domestic air cargo forecasts is limited by the continuing decreasing trend in domestic air cargo at the Airport, which does not correlate with economic variables such as employment and income, which generally have an increasing trend. In addition, in recent years, particularly since the oil price spike in 2008, an increasing amount of cargo that was transported by air has been handled by trucks due to lower ground transport costs. To evaluate the shift in domestic cargo from air to ground transport and the potential for future domestic air cargo growth, a complete dataset for the volume and value of domestic cargo carried by other modes, particularly by truck, is needed to evaluate the future role of the Airport in handling domestic air cargo. However, such a dataset at the regional level is not available.

Historically, the Airport domestic air cargo has followed national trends. As noted in the FAA's Aerospace Forecasts published in March 2015, the forecasts of domestic air cargo for the nation as a whole "are based on several assumptions specific to the cargo industry. First, security restrictions on air cargo transportation will remain in place. Second, most of the shift from air to ground transportation has occurred. Finally, long-term cargo activity will be tied to economic growth."* Therefore, given comparable trends in the Airport and national domestic air cargo, it is assumed that domestic air cargo growth at the Airport will approximate the growth rate forecast by the FAA for the nation as a whole—an average increase of 1.0% per year.

As shown in Table 3-20, domestic air cargo at the Airport is forecast to increase from 124,308 metric tons in 2015 to 151,700 metric tons in 2035—an average increase of 1.0% per year. The percent of domestic air cargo at the Airport is forecast to decrease from 64.3% in 2015 to 55.5% in 2035, reflecting faster forecast growth in international air cargo (an average increase of 2.9% per year between 2015 and 2035).

3.6.3.2 International Air Cargo

The forecasts of international air cargo at the Airport are based on an econometric model relating international air cargo trends in the Detroit Region to economic and airline industry metrics, including an evaluation of imports and exports, as summarized in Appendix B. As shown in Table 3-20, international air cargo at the Airport is forecast to increase from 69,143 metric tons in 2015 to 121,700 metric tons in 2035—an average increase of 2.9% per year. The percent of international air cargo at the Airport is forecast to increase from 35.7% in 2015 to 45.5% in 2035, reflecting continued U.S. economic growth, as measured by U.S. GDP, the strength of the U.S. dollar, and the continued growth in international airline service.

3.6.3.3 Total Air Cargo

Total air cargo at the Airport is forecast to increase from 193,451 metric tons in 2015 to 273,400 metric tons in 2035—an average rate of 1.7% per year, as shown on Figure 3-25 and in Table 3-20. Enplaned air cargo at the Airport is forecast to account for approximately 45% of total air cargo through 2035, with deplaned air cargo accounting for the remaining 55%. Passenger airlines are forecast to account for an increasing share of total air cargo—increasing from 48% in 2015 to 55% in 2035, reflecting the increasing use of belly cargo, particularly in international service.

*Federal Aviation Administration, *FAA Aerospace Forecast, Fiscal Years 2015-2035*, March 2015, www.faa.gov.

Table 3-20
HISTORICAL AND FORECAST DOMESTIC AND INTERNATIONAL TOTAL AIR CARGO
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
In metric tons

	Historical		Forecast			
	2014	2015	2020	2025	2030	2035
Air freight						
Domestic	111,295	112,585	118,300	124,400	130,700	137,400
International	75,810	63,881	79,000	90,500	102,600	115,300
Air freight total	187,105	176,466	197,300	214,900	233,300	252,700
Air mail *(a)*						
Domestic	10,129	11,723	12,300	12,900	13,600	14,300
International	4,798	5,262	5,600	5,800	6,100	6,400
Air mail total	14,927	16,985	17,900	18,700	19,700	20,700
Total air cargo						
Domestic	121,424	124,308	130,600	137,300	144,300	151,700
International	80,608	69,143	84,600	96,300	108,700	121,700
Air cargo total	202,032	193,451	215,200	233,600	253,000	273,400
Enplaned and deplaned air cargo						
Enplaned	90,757	87,869	97,400	106,000	114,100	122,600
Deplaned	111,275	105,582	117,800	127,600	138,900	150,800
Airport total	202,032	193,451	215,200	233,600	253,000	273,400
Total air cargo by all-cargo and passenger airlines						
All-cargo airline	101,714	100,953	106,200	111,600	117,400	123,400
Passenger airlines	100,317	92,498	109,000	122,000	135,600	150,000
Airport total	202,032	193,451	215,200	233,600	253,000	273,400

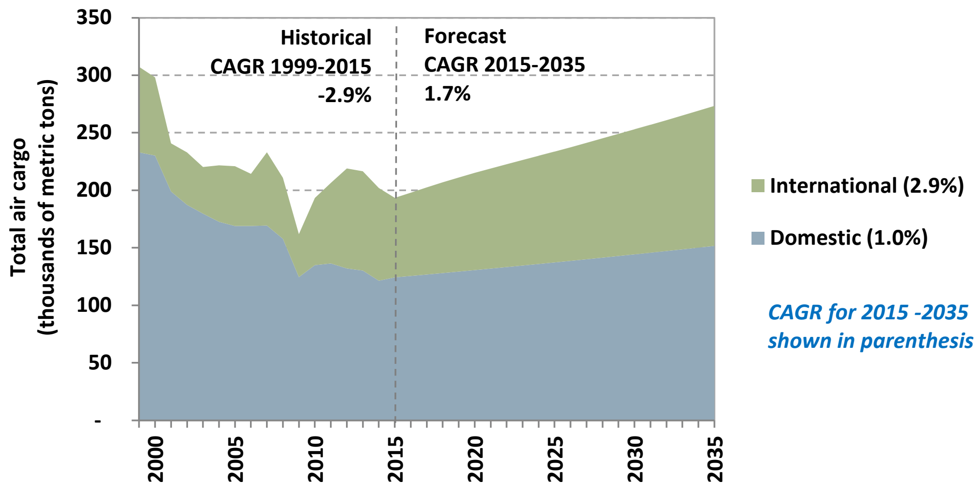
	Compound annual percent change				
	2015-2020	2020-2025	2025-2030	2030-2035	2015-2035
Air freight					
Domestic	1.0%	1.0%	1.0%	1.0%	1.0%
International	4.3	2.8	2.5	2.4	3.0
Air freight total	2.3	1.7	1.7	1.6	1.8
Air mail *(a)*					
Domestic	1.0	1.0	1.1	1.0	1.0
International	1.3	0.7	1.0	1.0	1.0
Air mail total	1.1	0.9	1.0	1.0	1.0
Total air cargo					
Domestic	1.0	1.0	1.0	1.0	1.0
International	4.1	2.6	2.5	2.3	2.9
Air cargo total	2.2	1.7	1.6	1.6	1.7
Enplaned and deplaned air cargo					
Enplaned	2.1	1.7	1.5	1.4	1.7
Deplaned	2.2	1.6	1.7	1.7	1.8
Airport total	2.2	1.7	1.6	1.6	1.7
Total air cargo by all-cargo and passenger airlines					
All-cargo airline	1.0	1.0	1.0	1.0	1.0
Passenger airlines	3.3	2.3	2.1	2.0	2.4
Airport total	2.2	1.7	1.6	1.6	1.7

(a) Includes small packages.

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material. Totals may not add due to rounding.

Sources: Historical—Wayne County Airport Authority records and U.S. Department of Transportation.
Forecast—LeighFisher, March 2016.

Figure 3-25
HISTORICAL AND FORECAST TOTAL AIR CARGO
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

CAGR = Compound annual growth rate

Source: Historical—Wayne County Airport Authority records.
Forecast—LeighFisher, March 2016.

3.6.4 Aircraft Operations

This section summarizes the forecasts of total aircraft operations, including passenger airline, all-cargo airline, general aviation, and military operations.

3.6.4.1 Forecast Approach and Methodology

The forecasts of total aircraft operations are derived from the forecasts of passenger and cargo demand described previously and an evaluation of general aviation and military operations. In particular:

- The forecasts of passenger airline aircraft departures are based on the enplaned passenger forecasts and assumptions regarding average aircraft size and enplaned passenger load factor.

- The forecasts of all-cargo airline aircraft departures are based on the air cargo forecasts and assumptions regarding average cargo tonnage per operation.

- The forecasts of general aviation aircraft operations are based on historical trends, the number of aircraft based at the Airport, the average daily utilization of those aircraft, assumptions regarding aircraft utilization in the future, and industry forecasts of general aviation activity such as those prepared by the FAA.

- The forecasts of military aircraft operations are based on data for the base year of the forecasts and carried forward through the forecast period. Military operations typically increase and decrease with geopolitical trends and therefore this activity may vary in a given year.

Table 3-21 presents the forecast assumptions for passenger and cargo airline aircraft operations, including assumptions for the average enplaned passenger load factor, the average number of seats per departure, and average cargo tonnage per cargo airline operation.

3.6.4.2 Passenger Airline Aircraft Operations

Passenger aircraft operations include total departures and arrivals performed by network and regional affiliate aircraft in the service of transporting passengers, as shown in Table 3-22. Passenger airline aircraft operation forecasts were calculated by dividing the enplaned passenger forecasts by sector (e.g., domestic and international) and category (e.g., network and regional affiliate carrier) by the estimated number of passengers enplaned per departure. In 2015, the estimated average number of passengers enplaned per departure for the Airport as a whole was 92.2 and is derived by multiplying the load factor by the average seats per departure (e.g., 83.9% x 109.9 = 92.2). This number is expected to increase slowly over the forecast period based on an estimated increase in the average number of seats per aircraft and an estimated load factor, or percent of available seats filled with passengers. The average number of passengers enplaned per departure is expected to reach approximately 102.0 in 2035. Dividing the enplaned passenger forecasts by the forecast number of passengers enplaned per departure yields passenger airline aircraft departure forecasts. Passenger airline aircraft departures at the Airport are forecast to increase from 183,729 in 2015 to 212,200 operations in 2035, an average increase of 0.7% per year, as shown in Table 3-22.

Table 3-21
COMMERCIAL AIRLINE AIRCRAFT OPERATIONS FORECAST ASSUMPTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Historical		Forecast			
	2014	2015	2020	2025	2030	2035
Seat per operation						
Domestic						
Network airlines	154.9	151.9	152.7	153.4	154.2	155.0
Low cost carriers	148.7	153.8	154.5	155.3	156.1	156.9
Regional airlines	59.4	62.6	65.7	68.9	72.2	75.7
Domestic total	97.9	104.4	107.3	110.2	113.2	116.2
International	238.4	222.3	223.4	224.5	225.7	226.8
Airport total	103.6	109.9	112.6	115.5	118.4	121.3
Load factor						
Domestic						
Network airlines	86.1%	86.2%	86.2%	86.2%	86.2%	86.2%
Low cost carriers	84.8%	83.1%	83.1%	83.1%	83.1%	83.1%
Regional airlines	81.1%	83.1%	83.1%	83.1%	83.1%	83.1%
Domestic total	84.1%	84.8%	84.8%	84.8%	84.8%	84.8%
International	78.9%	75.7%	76.2%	76.7%	77.2%	77.7%
Airport total	83.6%	83.9%	84.0%	84.0%	84.1%	84.2%
Air cargo per operation by all-cargo airlines (metric tons)	28.14	26.64	26.83	27.23	27.64	28.08

	Compound annual percent change				
	2015-2020	2020-2025	2025-2030	2030-2035	2015-2035
Seat per operation					
Domestic	0.1%	0.1%	0.1%	0.1%	0.1%
Network airlines	0.1	0.1	0.1	0.1	0.1
Low cost carriers	1.0	1.0	1.0	1.0	1.0
Regional airlines	0.5	0.5	0.5	0.5	0.5
Domestic total	0.1	0.1	0.1	0.1	0.1
International	0.5	0.5	0.5	0.5	0.5
Airport total	0.1	0.1	0.1	0.1	0.1
Load factor					
Domestic					
Network airlines	0.0	0.0	0.0	0.0	0.0
Low cost carriers	0.0	0.0	0.0	0.0	0.0
Regional airlines	0.0	0.0	0.0	0.0	0.0
Domestic total	0.0	0.0	0.0	0.0	0.0
International	0.1	0.1	0.1	0.1	0.1
Airport total	0.0	0.0	0.0	0.0	0.0
Total air cargo per operation (metric tons)	0.1	0.3	0.3	0.3	0.3

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.
Totals may not add due to rounding.

Sources: Historical—Wayne County Airport Authority records and OAG Worldwide Aviation Ltd, online database, accessed March 2016.
Forecast—LeighFisher, March 2016.

Table 3-22
HISTORICAL AND FORECAST COMMERCIAL AIRLINE DEPARTURES BY SECTOR
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Historical		Forecast			
	2014	2015	2020	2025	2030	2035
Passenger airlines						
Domestic						
Network airlines	58,270	62,930	68,470	72,800	77,010	81,350
Low cost carriers	15,460	16,986	18,100	19,240	20,360	21,510
Regional airlines	108,724	95,621	95,150	96,980	98,350	99,590
Domestic total	182,454	175,537	181,720	189,020	195,720	202,450
International	7,397	8,192	8,760	9,110	9,440	9,750
Subtotal—passenger airlines	189,851	183,729	190,480	198,130	205,160	212,200
All-cargo airlines	1,807	1,895	1,980	2,050	2,120	2,200
Airport total	191,658	185,624	192,460	200,180	207,280	214,400

	Compound annual percent change				
	2015-2020	2020-2025	2025-2030	2030-2035	2015-2035
Passenger airlines					
Domestic					
Network airlines	1.7%	1.2%	1.1%	1.1%	1.3%
Low cost carriers	1.3	1.2	1.1	1.1	1.2
Regional airlines	-0.1	0.4	0.3	0.3	0.2
Domestic total	0.7	0.8	0.7	0.7	0.7
International	1.3	0.8	0.7	0.6	0.9
Subtotal—passenger airlines	0.7	0.8	0.7	0.7	0.7
All-cargo airlines	0.9	0.7	0.7	0.7	0.7
Airport total	0.7	0.8	0.7	0.7	0.7

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Totals may not add due to rounding.

Sources: Historical—Wayne County Airport Authority records and U.S. Department of Transportation.
Forecast—LeighFisher, March 2016.

3.6.4.3 All-Cargo Airline Aircraft Operations

Cargo airline operations at the Airport include the flight activity by airlines dedicated exclusively to the transportation of freight, including integrated carriers such as FedEx and all-cargo airlines such as Atlas Air that operate freighter aircraft. Air carrier size aircraft that perform all-cargo operations at the Airport include widebody (e.g., Airbus A-300, DC-10, and MD-11) and narrowbody (e.g., Boeing 757) aircraft.

The forecast of all-cargo operations was developed by first estimating the share of future cargo tonnage expected to be carried by air carrier and commuter aircraft. The cargo tonnage expected to be carried by integrated airlines such as FedEx was then divided by an estimated cargo tons per operation ratio for integrated airlines to yield cargo operations for integrated airlines. For example, all-cargo airlines carried an estimated average of 26.64 metric tons per operation in 2015, as shown in Table 3-21. The ratio of tons per operation is expected to increase gradually over the forecast period to account for expected growth in cargo related to economic activity.

All-cargo airline aircraft departures at the Airport are forecast to increase an average of 0.7% per year from 1,895 in 2015 to 2,200 in 2035, as shown in Table 3-22.

3.6.4.4 General Aviation Aircraft Operations

General aviation activity includes all flight operations by aircraft other than scheduled or charter passenger aircraft and military aircraft. General aviation includes not only pilot training and recreational flights on small single engine or multi-engine propeller driven aircraft, but also operations on large business jet aircraft.

On a nationwide basis, the number of general aviation aircraft operations has been in slow decline due to factors such as increases in aircraft, fuel, and insurance costs, as well as increased avionic instrument requirements. The 2008-2009 economic recession and the financial credit crisis further reduced general aviation activity nationwide. For the future, the FAA expects general aviation traffic to recover slowly.

The flight operations of general aviation aircraft are categorized as local or itinerant operations. Local operations are flights that operate within visual range or close proximity of an airport. Itinerant operations typically include those flights that depart an airport destined for another airport and require filing flight plans with the local air traffic control authorities. Since 2009, itinerant operations have accounted for all general aviation operations at the Airport. In 2015, 5,843 itinerant general aviation operations were performed at the Airport, as shown in Table 3-23.

The total number of general aviation operations is forecast to average 5,800 operations between 2015 and 2035, consistent with historical trends since 2010.

In 2015, seven jet aircraft were based at the Airport. The total number of based aircraft at the Airport is forecast to remain unchanged through 2035.

3.6.4.5 Military Aircraft Operations

The number of military operations at the Airport averaged approximately 130 operations per year between 2010 and 2015. In 2015, 102 military operations were performed at the Airport, approximating the 6-year average. Military operations are expected remain at a level of about 100 operations through 2035, as shown in Table 3-23.

Table 3-23
HISTORICAL AND FORECAST AIRCRAFT OPERATIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Historical		Forecast			
	2014	2015	2020	2025	2030	2035
Commercial operations						
Air carrier *(a)*	243,117	276,898	301,190	315,020	328,010	341,120
Air taxi *(a)*	143,122	96,533	86,230	87,850	89,060	90,160
Total	386,239	373,431	387,420	402,870	417,070	431,280
General aviation						
Local	--	--	--	--	--	--
Itinerant	6,264	5,843	5,800	5,800	5,800	5,800
Total	6,264	5,843	5,800	5,800	5,800	5,800
Military						
Local	--	--	--	--	--	--
Itinerant	132	102	100	100	100	100
Total	132	102	100	100	100	100
Total Airport	392,635	379,376	393,320	408,770	422,970	437,180

	Compound annual percent change				
	2015-2020	2020-2025	2025-2030	2030-2035	2015-2035
Commercial operations					
Air carrier *(a)*	1.7%	0.9%	0.8%	0.8%	1.0%
Air taxi *(a)*	-2.2	4.0	0.3	0.2	-0.3
Total	0.7	0.8	0.7	0.7	0.7
General aviation					
Local	--	--	--	--	--
Itinerant	-0.1	0.0	0.0	0.0	0.0
Total	-0.1	0.0	0.0	0.0	0.0
Military					
Local	--	--	--	--	--
Itinerant	-0.4	0.0	0.0	0.0	0.0
Total	-0.4	0.0	0.0	0.0	0.0
Total Airport	0.7	0.8	0.7	0.7	0.7

Note: The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

Totals may not add due to rounding.

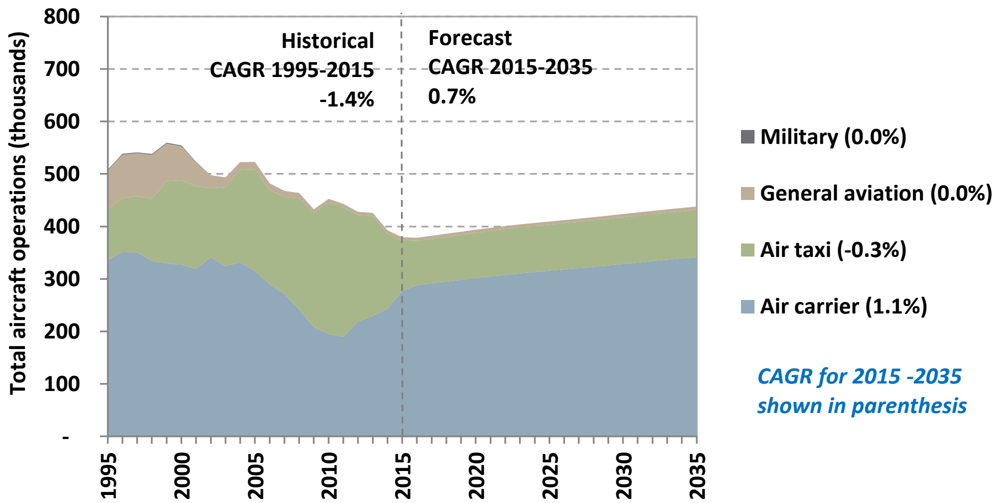
(a) Includes air taxi, unscheduled, corporate, and ferry operations and empty flights.

Sources: Historical—Federal Aviation Administration, Air Traffic Activity System (ATADS), www.faa.gov.
Forecast—LeighFisher, March 2016.

3.6.4.6 Total Aircraft Operations

Total aircraft operations at the Airport are forecast to increase from 379,376 in 2015 to 435,180 operations in 2035 an average increase of 0.7% per year, as shown in Table 3-23 and on Figure 3-26.

Figure 3-26
HISTORICAL AND FORECAST AIRCRAFT OPERATIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: The forecasts presented in this figure were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

CAGR = Compound annual growth rate

Source: Historical—Wayne County Airport Authority records.
Forecast—LeighFisher, March 2016.

3.7 COMPARISON WITH THE FAA TAF

Table 3-24 presents a comparison of the baseline aviation demand forecasts prepared for Detroit Metropolitan Wayne County Airport with the FAA 2015 TAF for the Airport. The baseline unconstrained forecasts are the "preferred" forecasts recommended for FAA approval. The forecasts are compared for the components of total enplaned passengers, commercial aircraft operations and total aircraft operations. The format of Table 3-24 is based on the template provided by the FAA for the comparison of airport planning forecasts and the FAA TAF.* As required, results are presented for the base year of 2015 and forecast horizons years, which are equal to the base year, plus 1, 5, 10, and 15 years (2016, 2020, 2025, and 2030). The Master Plan Update aviation demand forecasts have been compared graphically with the FAA 2015 TAF on the figures presented throughout this report, including Figures 3-1 and 3-3.

*U.S. Department of Transportation, Federal Aviation Administration, Forecasting Aviation Activity by Airport, July 2001, and Review and Approval of Aviation Forecasts, June 2008, http://www.faa.gov.

Table 3-24
FAA TAF FORECAST COMPARISON
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Year *(a)*	Master Plan Update forecasts	FAA 2015 TAF	Master Plan Update forecasts vs. 2015 TAF (percent variance)
Passenger enplanements				
Base yr.	2015	16,681,255	15,984,984	4.4%
Base yr. + 5yrs.	2020	18,019,000	18,008,678	0.1%
Base yr. + 10yrs.	2025	19,230,200	19,584,828	-1.8%
Base yr. + 15yrs.	2030	20,421,800	21,081,030	-3.1%
Commercial operations *(b)*				
Base yr.	2015	373,431	374,525	-0.3%
Base yr. + 5yrs.	2020	387,420	424,531	-8.7%
Base yr. + 10yrs.	2025	400,870	472,551	-15.2%
Base yr. + 15yrs.	2030	415,070	507,697	-18.2%
Total operations *(c)*				
Base yr.	2015	379,376	380,160	-0.2%
Base yr. + 5yrs.	2020	393,320	429,754	-8.5%
Base yr. + 10yrs.	2025	406,770	477,774	-14.9%
Base yr. + 15yrs.	2030	420,970	512,920	-17.9%

(a) The Master Plan Update forecasts were prepared on a calendar year basis and the FAA 2015 TAF was prepared on a U.S. federal fiscal year basis (October through September).
(b) Commercial operations include operations by passenger airlines, all-cargo airlines, and air taxi operators.
(c) Total operations include commercial operations plus operations by general aviation and military.

Sources: Base year 2015 (actual)—Wayne County Airport Authority records and Federal Aviation Administration, Air Traffic Activity System (ATADS), www.faa.gov.
Master Plan Update Forecasts—LeighFisher, March 2016.
FAA 2015 TAF—U.S. Department of Transportation, Federal Aviation Administration.

3.7.1 Comparison with the FAA 2015 TAF

The key findings of the comparison of the Airport Master Plan Update aviation demand forecasts with the FAA 2015 TAF are:

- The forecast of enplaned passengers for the Airport approximates the TAF in 2020 and is lower in 2025. The variance between the Airport Master Plan Update enplaned passenger forecast and the FAA 2015 TAF is 0.1% in 2020 and 1.8% in 2025, as shown in Table 3-24.

- The forecast of commercial operations for the Airport is less than the FAA 2015 TAF by 8.7% in 2020 and 15.2% in 2025.

- The forecast of total aircraft operations for the Airport is less than the FAA 2015 TAF by 8.5% in 2020 and 14.9% in 2025.

Overall, the Master Plan Update aviation demand forecasts are consistent with the FAA 2015 TAF and "differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period", as stipulated in the FAA forecast guidance.

FAA guidance recognizes that a comparison of airport planning forecasts and the FAA TAF is limited by the use of: calendar year data for an airport master plan vs. FFY data in the FAA TAF; and the absence of non-revenue and military charter passengers in the FAA TAF.

Airport planning forecasts are based on airport data (as reported by airlines) to enable an airport operator to track actual and forecast activity and reconcile forecast activity with airport budgets which are based on airline reported data.

Table 3-25 presents a summary of the Master Plan Update aviation demand forecasts using a second template provided by the FAA.

Table 3-25
SUMMARY OF MASTER PLAN UPDATE FORECASTS USING FAA TEMPLATE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

		Forecast				Average annual compound growth rates			
	Base year 2015	Base year + 1 year 2016	Base year + 5 years 2020	Base year + 10 years 2025	Base year + 15 years 2030	Base year to +1 year 2015 - 2016	Base year to +5 years 2015 - 2020	Base year to +10 years 2015 - 2025	Base year to +15 years 2015 - 2030
Passenger enplanements									
Air carrier *(a)*	11,884,412	12,252,900	12,828,400	13,683,900	14,525,100	3.1%	1.5%	1.4%	1.3%
Commuter *(b)*	4,796,843	4,874,400	5,190,600	5,546,300	5,896,700	1.6%	1.6%	1.5%	1.4%
Total	16,681,255	17,127,300	18,019,000	19,230,200	20,421,800	2.7%	1.6%	1.4%	1.4%
Aircraft operations									
Itinerant									
Air carrier	276,898	287,920	301,190	315,020	328,010	4.0%	1.7%	1.3%	1.1%
Commuter/air taxi	96,533	84,150	86,230	87,850	89,060	-12.8%	-2.2%	-0.9%	-0.5%
Total commercial operations	373,431	372,070	387,420	402,870	417,070	-0.4%	0.7%	0.8%	0.7%
General aviation	5,843	5,800	5,800	5,800	5,800	-0.7%	-0.1%	-0.1%	0.0%
Military	102	100	100	100	100	-2.0%	-0.4%	-0.2%	-0.1%
Local									
General aviation	--	--	--	--	--	--	--	--	--
Military	--	--	--	--	--	--	--	--	--
Total operations	379,376	377,970	393,320	408,770	422,970	-0.4%	0.7%	0.7%	0.7%
Cargo/mail (enplaned + deplaned tons)	193,451	197,910	215,200	233,600	253,000	2.3%	2.2%	1.9%	1.8%
Based Aircraft									
Single-engine (nonjet)	--	--	--	--	--	--	--	--	--
Multiengine (nonjet)	--	--	--	--	--	--	--	--	--
Jet engine	7	7	7	7	7	0.0%	0.0%	0.0%	0.0%
Helicopter	--	--	--	--	--	--	--	--	--
Other	--	--	--	--	--	--	--	--	--
Total	7	7	7	7	7	0.0%	0.0%	0.0%	0.0%
Operational factors									
Average aircraft size (seats)									
Air Carrier *(a)*	158.9	159.0	159.5	160.2	160.9				
Commuter *(b)*	62.6	63.2	65.7	68.9	72.2				
Average enplaning load factor									
Air Carrier *(a)*	84.3%	84.3%	84.4%	84.4%	84.5%				
Commuter *(b)*	83.1%	83.1%	83.1%	83.1%	83.1%				
GA operations per based aircraft	835	829	829	829	829				

(a) The Airport Master Plan Update forecasts were prepared on a calendar year basis and the FAA 2015 TAF was prepared on a U.S. federal fiscal year basis (October through September).
(b) Commercial operations include operations by passenger airlines, all-cargo airlines, and air taxi operators.
(c) Total operations include commercial operations plus operations by general aviation and military.

Sources: Base year 2015 (actual)—Wayne County Airport Authority records and Federal Aviation Administration, Air Traffic Activity System (ATADS), www.faa.gov.
Master Plan Update Forecasts—LeighFisher, March 2016.

Chapter 4
ASSESSMENT OF EXISTING CONDITIONS

This chapter provides background data on the Airport and a comprehensive inventory of existing Airport facilities and conditions. The information will provide the basis for determining future facility requirements and the formulation of Airport development alternatives. The chapter covers the following technical categories:

- Airfield and Airspace
- Passenger Terminal Complex
- Ground Transportation and Parking
- Air Cargo
- General Aviation and Military
- Airline and Airport Support
- Environmental Conditions

4.1 AIRPORT SETTING

The Airport is owned and operated by the Authority. As shown on Figure 4-1, the Airport is located in the city of Romulus, about 21 miles west of downtown Detroit and 25 miles east of Ann Arbor. As of 2013, Detroit had an estimated population of 688,700, making it the largest city in the state of Michigan; the fourth largest in the Midwest region; and the 18th largest in the United States.

The Airport is classified in the FAA's National Plan of Integrated Airport Systems (NPIAS) as a Commercial Service Primary Airport, serving origin-destination passengers (i.e., passengers beginning or ending their air journeys in Detroit) and connecting passengers transferring from one flight to another. The Airport is an important passenger connecting hub in the route system of Delta Air Lines and its regional/commuter affiliates. According to 2014 data published by Airports Council International-North America, the Airport is the nation's 17th busiest in terms of passenger traffic; 16th busiest in terms of total aircraft operations; and 25th busiest in terms of air cargo tonnage.

In addition to Delta, the Airport also accommodates numerous other air carriers, including: Air France, Alaska Airlines, American Airlines and its affiliates, Frontier Airlines, Icelandair, jetBlue Airways, Lufthansa, Royal Jordanian, Southwest Airlines, Spirit Airlines, United Airlines and its affiliates, and Virgin Atlantic.

4.1.1 Airport Site

The Airport occupies an approximate 6,200-acre site that is bounded by Goddard Road to the north; Middle Belt Road to the east; Eureka Road to the south; and Wayne and Vining roads to the west. Primary access is provided from the north via W. G. Rogell Drive and from the south via John D. Dingell Drive.

LEGEND

Urban areas

State boundary

County boundary

N

2.5 0 2.5 5

Graphic Scale in Miles

Figure 4-1

VICINITY MAP

Assessment of Existing Conditions
Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

LeighFisher

Figure 4-2 presents the overall Airport site, which consists of the following primary components:

- **Airfield** – The airfield occupies about 55% of the total Airport land area, and includes six runways (four north-south parallel runways and two east-west cross-wind runways), and associated taxiways, aprons, hold pads, and other safety-related protection zones.

- **Passenger Terminal Complex** – The passenger terminal complex includes two terminals with four concourses accommodating 147 aircraft gates; passenger processing facilities that accommodate ticketing, baggage claim, and security screening functions; ground transportation facilities including access roadways, parking garages, and surface parking lots; air cargo terminals (belly freight); and an on-Airport hotel.

- **Air Cargo** – The air cargo area includes facilities for United Parcel Service, Delta Air Lines, FedEx, the United States Postal Service, and a consolidated facility operated by other airlines.

- **General Aviation** – One FBO—Signature Flight Support—is located on the north side of the Airport and provides a range of services for general aviation users, including fueling and maintenance.

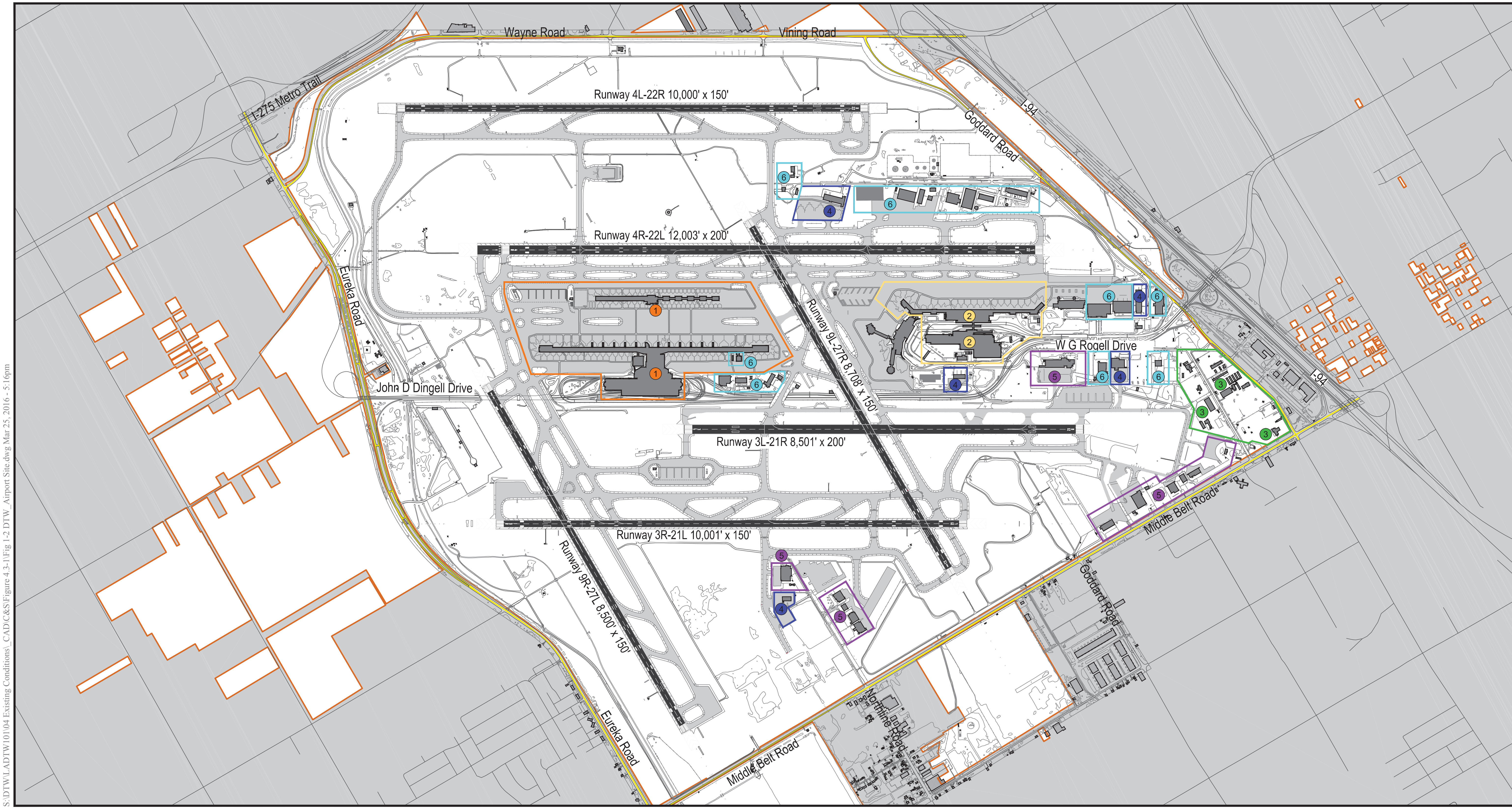
- **Rental Car** – Rental car storage, customer processing and ready/return facilities are located on the north side of the Airport, along Lucas Drive. Customers are bussed to and from the terminal Ground Transportation Centers (GTCs) via company-operated shuttles.

- **Support Facilities** – Primary support facilities are located throughout the site, and include: airline maintenance facilities; airline catering and flight kitchens; a fuel farm located on the northwest side of the Airport; deicing control facilities; FAA airport traffic control facilities; employee parking; ARFF; and airfield maintenance and support facilities.

4.1.2 Airport Access

Access to the Airport is provided predominately via Interstate 94 (I-94), Interstate 275 (I-275), Merriman Road, Eureka Road, and John D. Dingell Drive. Vehicles traveling to the passenger terminal complex from I-94 typically use Merriman Road, which provides direct entry to the passenger terminal curbsides and parking facilities and is renamed W. G. Rogell Drive once on Airport property. Secondary access to and from the terminal complex is also provided via Eureka Road which connects to John D. Dingell Drive. Eureka Road connects to I-275 just west of the Airport.

Vehicles traveling to and from the aviation-related facilities located along Lucas Drive, which include the rental car facilities, use Middle Belt Road to connect to I-94. Access to facilities on the west side of the airfield is provided by Goddard Road and West Service Road.



LEGEND

Airport property line

Airport perimeter roadways

1 McNamara Terminal and parking facilities

2 North Terminal and parking facilities

3 Rental car facilities

4 Air cargo facilities

5 General aviation facilities

6 Airline and Airport support facilities

NORTH

0 1000' 2000' 4000'

Figure 4-2
AIRPORT SITE

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

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4.1.3 Existing Land Uses

Existing Airport land uses are depicted on Figure 4-3. The use and acreage of Airport land by functional designation is presented in Table 4-1, and defined below.

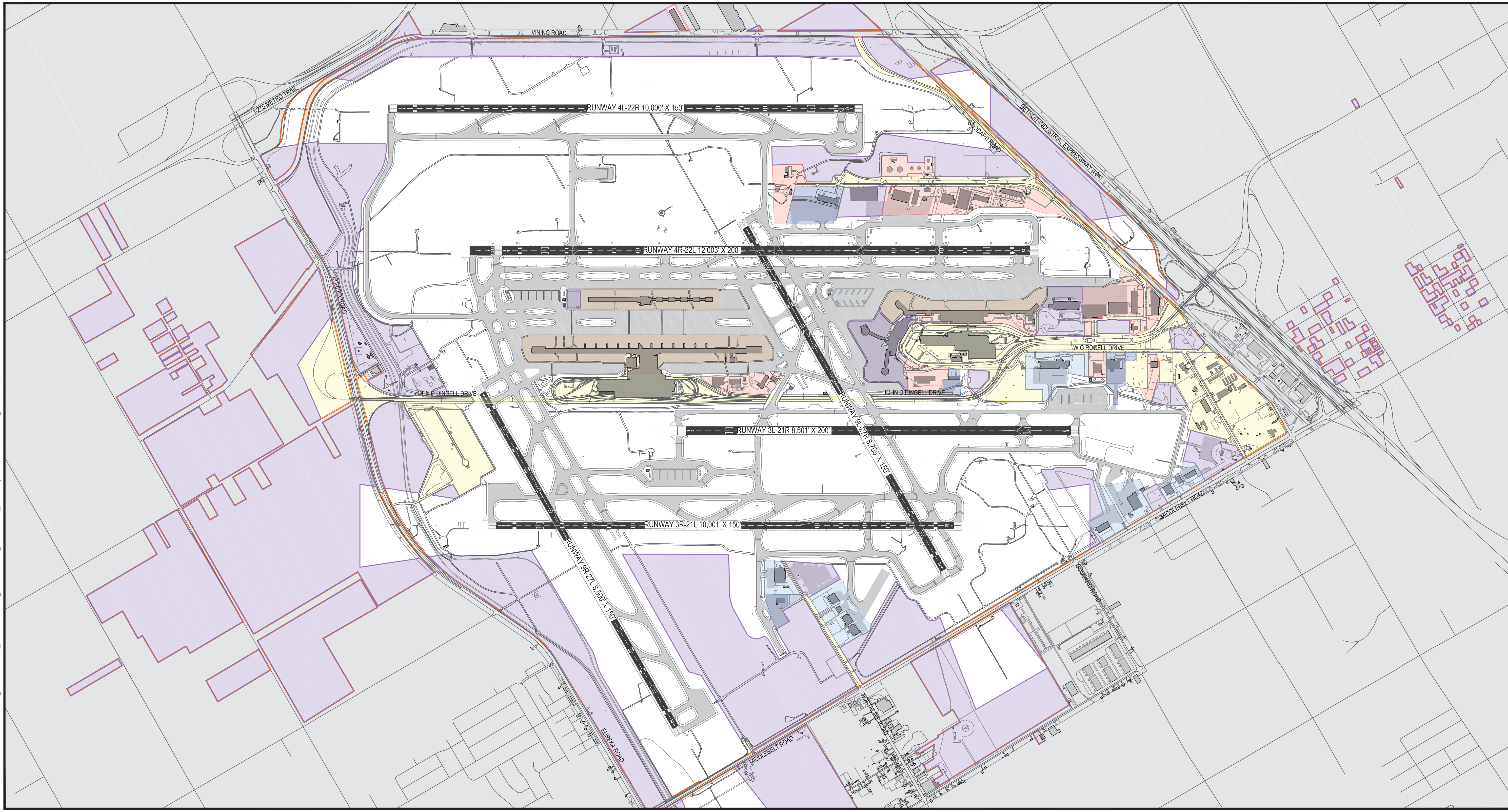
- **Airfield** – Runways, taxiways, aprons and safety areas related to the movement of aircraft.
- **Passenger Terminal** – Passenger terminal, concourses, and gates.
- **Ground Transportation and Parking** – Landside facilities including primary roadways, terminal curbsides, and vehicle parking.
- **Air Cargo** – Areas utilized and dedicated to the movement, distribution, and delivery of cargo.
- **General Aviation** – FBO and aircraft service areas where aviation services are provided to general aviation users; includes hangars, parking aprons, offices, and fuel storage
- **Aviation Support** – Facilities that support the operation and maintenance of the airport, including but not limited to: fuel storage, airline catering facilities, ground support equipment storage and maintenance facilities, airport maintenance facilities, etc.
- **Vacant/Reserved** – Areas owned and controlled by the Authority for future aviation- and/or non-aviation related development.
- **Commercial Development** – Properties leased to private entities for office, warehouse, and other revenue-generating development.

Large areas of Airport property located south of the Airport were acquired by the Authority for noise mitigation purposes. Although much of this land is currently undeveloped, the areas are available for future aviation and non-aviation related development.

Table 4-1
EXISTING AIRPORT LAND USES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Land use	Area (acres)	Percent of total
Airfield	3,404	55%
Passenger terminal	139	2
Ground transportation and parking	376	6
Air cargo	38	1
General aviation	86	1
Aviation support	131	2
Vacant/reserved	2,032	33
Commercial development	17	<1
Total	6,224	100%

Source: LeighFisher, January 2016.



S:\DTW\LADTW101\04 Existing Conditions_CAD\C&S\Figure 4.3-1\Fig 1-3 DTW_On-Airport Land Uses.dwg Mar 27, 2016 - 11:53am

LEGEND

- Airfield
- Passenger terminal
- Ground transport and parking
- Air cargo
- General aviation
- Aviation support
- Vacant / reserved
- Commercial development

NORTH

0 1000' 2000' 4000'

Figure 4-3
ON-AIRPORT LAND USES

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

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4.1.4 Ongoing Studies

The Authority has several ongoing studies that are being prepared concurrent with the Master Plan Update. These studies include:

- **Project OASIS** – beautification and wayfinding project for the north entrance to the Airport.
- **Economy parking** – expanding economy parking south of the McNamara Terminal to help balance demand and increase customer service.
- **Yellow Lot conversion** – exploring the potential of reopening the Yellow Lot for employee parking.
- **Rogell-Burton Intersection Geometry Study** – studying the use of a "Michigan U-turn" to improve flow at this intersection.
- **Planning and Design Related Services for Rental Car Facility Improvements** – on-call contract for rental car related projects.

The results and conclusions of these studies will be incorporated into relevant portions of the Master Plan Update throughout the planning process.

4.2 AIRFIELD AND AIRSPACE

This section provides an overview of existing airfield facilities as well as airspace provisions.

4.2.1 Airfield

Airfield facilities include those that directly support aircraft operations such as the runways, taxiways, aprons, and navigational aids (NAVAIDs). Figure 4-4 depicts the Airport's airfield configuration.

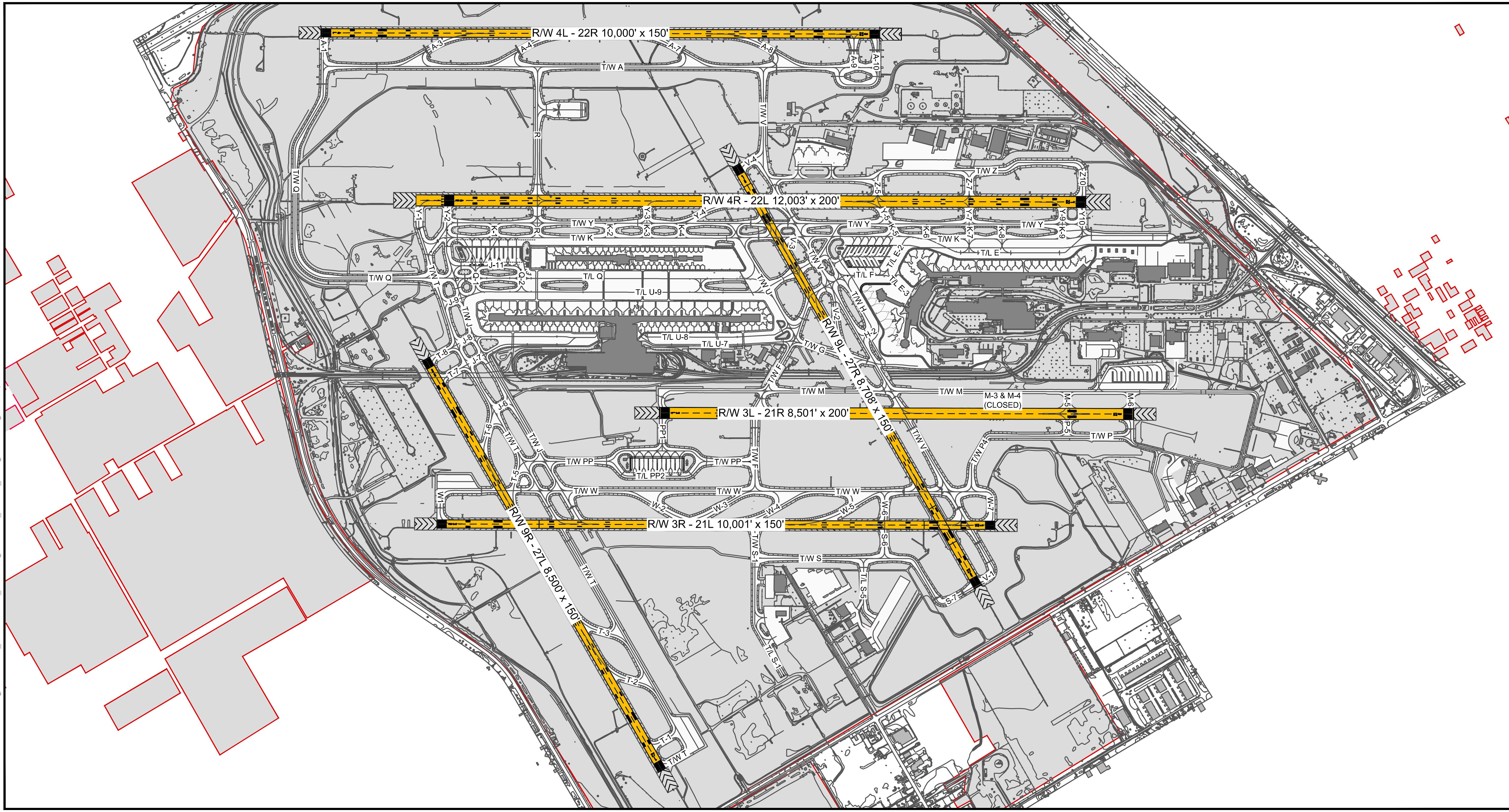
4.2.1.1 Runways

The Airport has six runways, including four parallel runways oriented northeast-southwest (designated 4L-22R, 4R-22L, 3L-21R, and 3R-21L) and two parallel runways oriented east-west (designated 9L-27R and 9R-27L). The published lengths and widths of each runway are presented in Table 4-2. Runway 4R has a displaced arrival threshold of 509 feet, which impacts the landing distance available.

Table 4-2
RUNWAY DIMENSIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Runway	Length (ft)	Width (ft)
4L-22R	10,000	150
4R-22L	12,003	200
3L-21R	8,501	200
3R-21L	10,001	150
9L-27R	8,708	150
9R-27L	8,500	150

Source: Federal Aviation Administration, Airport Facility Directory, February 2016.



LEGEND

	Runway pavement		Existing building off-airport	T/W	Taxiway
	Taxiway / Apron pavement		Fence	T/L	Taxilane
	Other pavement in use		Airport property line		
	Existing building on-airport	R/W	Runway		

NORTH

0 850' 1700' 3400'

Figure 4-4
AIRFIELD CONFIGURATION

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

Source: HNTB, March 2016

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4.2.1.1.1 Runway Design Code

The existing Runway Design Codes (RDC) for each runway end are summarized in Table 4-3, which also presents approach visibility minima, decision height, and the instrument approach category for each runway end. The approach visibility minima and decision height are determined by the lowest available approach for Aircraft Approach Category (AAC) D aircraft for each runway end.

4.2.1.1.2 Runway Bearing Strengths

Table 4-4 summarizes the runway pavement bearing strengths for each runway at the Airport.

Table 4-3
RUNWAY DESIGN CODE DESIGNATIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Runway	RDC	Approach visibility minimum	Decision height (ft)	Instrument approach category
4L	D/V/1200	600 feet	0	CAT IIIB
22R	D/V/1600	1,200 feet	100	SA CAT II
4R	D/V/1200	600 feet	0	CAT IIIB
22L	D/V/1600	1,200 feet	100	SA CAT II
3L	D/V/VIS	3 miles	1,000	Visual
21R	D/V/VIS	3 miles	1,000	Visual
3R	D/V/1200	600 feet	0	CAT IIIB
21L	D/V/1600	1,200 feet	100	SA CAT II
9L	D/V/VIS	3 miles	1,000	Visual
27R	D/V/2400	1/2 mile	200	CAT I
9R	D/V/VIS	3 miles	1,000	Visual
27L	D/V/1600	1,600 feet	100	SA CAT II

Source: Federal Aviation Administration, Terminal Procedures Publication/ Airport Diagrams, February 2016.

Table 4-4
RUNWAY STRENGTH
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Landing gear system	4L-22R	4R-22L	3L-21R	3R-21L	9L-27R	9R-27L
Single wheel (SW)	100	100	100	100	100	100
Double wheel (DW)	200	185	185	200	185	185
Dual tandem (DTW)	350	350	350	350	350	350
Double dual tandem (DDTW)	750	N/A	N/A	750	N/A	N/A

Note: Runway bearing strengths are shown in thousand pounds (000 pounds).

Source: Federal Aviation Administration, Airport Facility Directory, February 2016.

4.2.1.1.3 Declared Distances

Table 4-5 presents the declared distances for each runway end for takeoff run available (TORA), takeoff distance available (TODA), accelerate-stop distance available (ASDA), and the landing distance available (LDA).

Table 4-5
RUNWAY DECLARED DISTANCES (in feet)
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Runway	TORA *(a)*	TODA *(b)*	ASDA *(c)*	LDA *(d)*
4L	10,000	10,000	10,000	10,000
22R	10,000	10,000	10,000	10,000
4R	12,003	12,003	12,003	11,494
22L	12,003	12,003	12,003	12,003
3L	8,501	8,501	8,501	8,501
21R	8,501	8,501	8,501	8,501
3R	10,001	10,001	10,001	10,001
21L	10,001	10,001	10,001	10,001
9L	8,708	8,708	8,618	8,618
27R	8,708	8,708	8,708	8,708
9R	8,500	8,500	8,500	8,500
27L	8,500	8,500	8,500	8,500

(a) The length of the runway less any length of runway available and or unsuitable for takeoff run computations.
(b) The TORA plus any length of any remaining runway and or clearway beyond the far end of the TORA.
(c) The length of the runway plus the length of any stopway beyond the far end of the runway less any length of runway and or stopway unavailable and / or unsuitable for landing distance computations.
(d) The runway length declared available and suitable for a landing aircraft.

Source: Federal Aviation Administration, Airport Facility Directory, February 2016.

4.2.1.1.4 Runway Dimensional Standards

Runway dimensional standards and protected areas associated with the runways are presented in Table 4-6. The dimensional standards and protected areas are based on the size of the aircraft utilizing the runway and approach visibility minimums, with larger aircraft and lower approach visibility minima resulting in larger dimensions and protected areas.

Table 4-6
RUNWAY DIMENSIONAL STANDARDS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Geometry Element	Runway 4L	Runway 22R	Runway 4R	Runway 22L	Runway 3L	Runway 21R	Runway 3R	Runway 21L	Runway 9L	Runway 27R	Runway 9R	Runway 27L
Runway Length	10,000’	10,000’	12,003’	12,003’	8,501’	8,501’	10,001’	10,001’	8,708’	8,708’	8,500’	8,500’
Displaced Threshold Length	N/A	N/A	509’	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Runway Width	150’	150’	200’	200’	200’	200’	150’	150’	150’	150’	150’	150’
Runway Design Code	D/V/1200	D/V/1600	D/V/1200	D/V/1600	D/V/VIS	D/V/VIS	D/V/1200	D/V/1600	D/V/VIS	D/V/2400	D/V/VIS	D/V/1600
Approach Visibility Minimum	600’	1,200’	600’	1,200’	3 miles	3 miles	600 feet	1,200’	3 miles	0.5 mile	3 miles	1,600’
Runway Shoulder Width	35’	35’	39’	39’	*0’*	*0’*	35’	35’	35’	35’	35’	35’
Runway Blast Pad Width	220’	220’	281’	281’	220’	220’	220’	220’	220’	220’	220’	220’
Runway Blast Pad Length	400’	400’	400’	434’	443’	400’	400’	400’	400’	400’	400’	400’
Runway Centerline to Holdbars Distance	286’	286’	286’	286’	256’	256’	286’	286’	286’	286’	286’	286’
Maximum Crosswind Component	20 knots	20 knots	20 knots	20 knots	20 knots	20 knots	20 knots	20 knots	20 knots	20 knots	20 knots	20 knots
Runway Marking Type	Precision	Precision	Precision	Precision	Non Precision	Non Precision	Precision	Precision	Precision	Precision	Precision	Precision
Pavement Surface Type	PCC	PCC	PCC	PCC	PCC/AC	PCC/AC	PCC	PCC	PCC	PCC	PCC	PCC
Runway Safety Area Width	500'	500’	500’	500’	500’	500’	500’	500’	500’	500’	500’	500’
Runway Safety Area Length Beyond Stop End	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	*911’*	1,000'	1,000'	1,000'
Runway Safety Area Length Prior to Landing Threshold	600'	600'	600'	600'	600'	600'	600'	600'	600'	600'	600'	600'
Runway Object Free Area Width	800'	800'	800'	800'	800'	800'	800'	800'	800'	800'	800'	800'
Runway Object Free Area Length Beyond Stop End	1,000'	*988'*	1,000'	1,000'	1,000'	1,000'	1,000'	1,000'	*392’*	1,000’	1,000'	*926’*
Runway Object Free Area Length Prior to Landing Threshold	600'	600'	600'	600'	600'	600'	600'	600'	600'	600'	600'	600'
Runway Obstacle Free Zone Width	400'	400'	400'	400'	400'	400'	400'	400'	400'	400'	400'	400'
Runway Obstacle Free Zone Length Beyond Stop End	200'	200'	200'	200'	200'	200'	200'	200'	200'	200'	200'	200'
Arrival Runway Protection Zone Length	2,500’	2,500’	2,500’	2,500’	1,700’	1,700’	2,500’	2,500’	1,700’	2,500’	1,700’	2,500’
Arrival Runway Protection Zone Inner Width	1,000’	1,000’	1,000’	1,000’	500’	500’	1,000’	1,000’	500’	1,000’	500’	1,000’
Arrival Runway Protection Zone Outer Width	1,750’	1,750’	1,750’	1,750’	1,010’	1,010’	1,750’	1,750’	1,010’	1,750’	1,010’	1,750’
Departure Runway Protection Zone Length	1,700’	1,700’	1,700’	1,700’	1,700’	1,700’	1,700’	1,700’	1,700’	1,700’	1,700’	1,700’
Departure Runway Protection Zone Inner Width	500’	500’	500’	500’	500’	500’	500’	500’	500’	500’	500’	500’
Departure Runway Protection Zone Outer Width	1,010’	1,010’	1,010’	1,010’	1,010’	1,010’	1,010’	1,010’	1,010’	1,010’	1,010’	1,010’

Notes: AC: Asphalt Concrete
PCC: Portland Cement Concrete

Source: Federal Aviation Administration, Advisory Circular 150/5300-13A, *Airport Design* Change 1 and HNTB, February 2016.

4.2.1.1.5 Runway Protection Zone Inventory

An inventory of objects and land uses in the Runway Protection Zone (RPZ) for each runway end was completed and is summarized in Appendix C. Objects are classified by their type, description, designation of on- or off-airport, whether or not they are within the Central Portion of the RPZ, and whether or not it is an allowable use. Land use is controlled based on various guidance, including FAA AC 150/5300-13A, *Airport Design* and FAA's *Memorandum for Interim Guidance on Land Uses Within a Runway Protection Zone* (September 27, 2012).

4.2.1.2 Taxiways

FAA criteria for taxiway width and taxiway shoulder width are defined in terms of the Taxiway Design Group (TDG) of an aircraft, which is a function of undercarriage dimensions. The Airport's critical TDG is 6, representative of the Boeing 777-300ER aircraft. The taxiway network is depicted on Figure 4-4. Parallel and cross-field taxiways are typically 75 feet wide, while connector and runway entrance/exit taxiways vary widely in width as a result of the fillet needed to accommodate turning movement.

Starting on the west side of the Airport, Taxiway A is a full-length parallel taxiway for Runway 4L-22R and is connected to the runway by eight exit-taxiways. Taxiway A is 75 feet wide while the exit-taxiways are each at least 115 feet wide. Taxiway Q is a 75 feet wide end-around taxiway connecting to the 4L end of Runway 4L-22R. North of Taxiway Q, connecting Taxiway A with the McNamara Terminal ramp area, is Taxiway R. This ramp connector is 75 feet wide. Also connecting to Taxiway A and located north of Taxiway R is Taxiway V. Taxiway V also serves as a full-length parallel to Runway 9L-27R and is connected to the runway by four exit-taxiways.

Taxiway Z runs parallel to Runway 4R-22L, from Taxiway V to the end of Runway 22L. It is 75 feet wide and connects to the runway by three exit-taxiways. Taxiway Z also serves cargo and maintenance facilities. Taxiway Y also runs parallel to Runway 4R-22L and is 75 feet side, but is located on the east side of the runway. Unlike Taxiway Z, Taxiway Y is a full-length parallel and connects to the runway with eight exit-taxiways.

Taxiway K runs parallel to Taxiway Y and connects to the ramps at the McNamara and North Terminals. There are nine ramp-connectors used to access these terminals. Taxiway U runs parallel to Runway 9L-27R but only serves the northern apron of the McNamara Terminal. On the north side of Runway 9L-27R, adjacent to the Smith Terminal, Taxiway H serves a similar purpose.

Taxiway G crosses Runway 9L-27R and connects the McNamara Terminal apron with the North Terminal apron. Taxiway F also connects the two terminals, but continues across Runway 3L-21R before terminating at Taxiway W.

Taxiways J and T run parallel to Runway 9R-27L and also connect to Runway 4R-22L. Taxiway T is a full-length parallel, while Taxiway J terminates at Runway 3R-21L. Taxiway T connects to the runway with seven exit-taxiways and Taxiway J connects to Taxiway T with five ramp-connectors.

Taxiway PP is located between the 3-21 parallel runways. It connects Taxiway J with Taxiway F and provides access to deicing facilities. It has one exit-taxiway connecting directly to the 3L end of Runway 3L-21R.

Taxiway M is a 75-foot wide full-length parallel taxiway for Runway 3L-21R and is connected to the runway by two exit-taxiways. Taxiway P is located on the east side of Runway 3L-21R and only operates north of Runway 9L-27R.

Taxiway W is a 75-foot wide full-length parallel taxiway for Runway 3R-21L and is connected to the runway by seven exit-taxiways. Taxiway S is located on the east side of Runway 3R-21L and serves facilities located on the east side of the Airport. There are four exit-taxiways to connect to Runway 3R-21L.

4.2.1.3 Remain-Over-Night Parking

As depicted on Figure 4-5, the Airport currently has five designated remain overnight parking (RON) areas. Area A is located near the Berry Terminal Building and can accommodate up to five narrowbody aircraft. Area B is located adjacent the Smith Terminal Building and can accommodate six narrowbody aircraft, three 757-300 aircraft, and two large regional aircraft simultaneously. Area B can also accommodate two widebody aircraft. When these widebody aircraft are present, one narrowbody spot is eliminated and only one of the three 757-300 positions is available. Area C is located along Taxiway Z adjacent to connector Taxiway Z-5 and can accommodate two narrowbody aircraft or one widebody aircraft. Area D is located east of Runway 3R-21L between Taxiways S and S-5, and can accommodate two widebody parking positions. Area E is located north of the McNamara Terminal Concourse C and can accommodate three narrowbody aircraft and one widebody aircraft.

In total, the RON areas can accommodate a maximum of 21 narrowbody or smaller aircraft, and up to 15 aircraft if the maximum number of widebody aircraft positions are used.

4.2.1.4 Deicing Pads

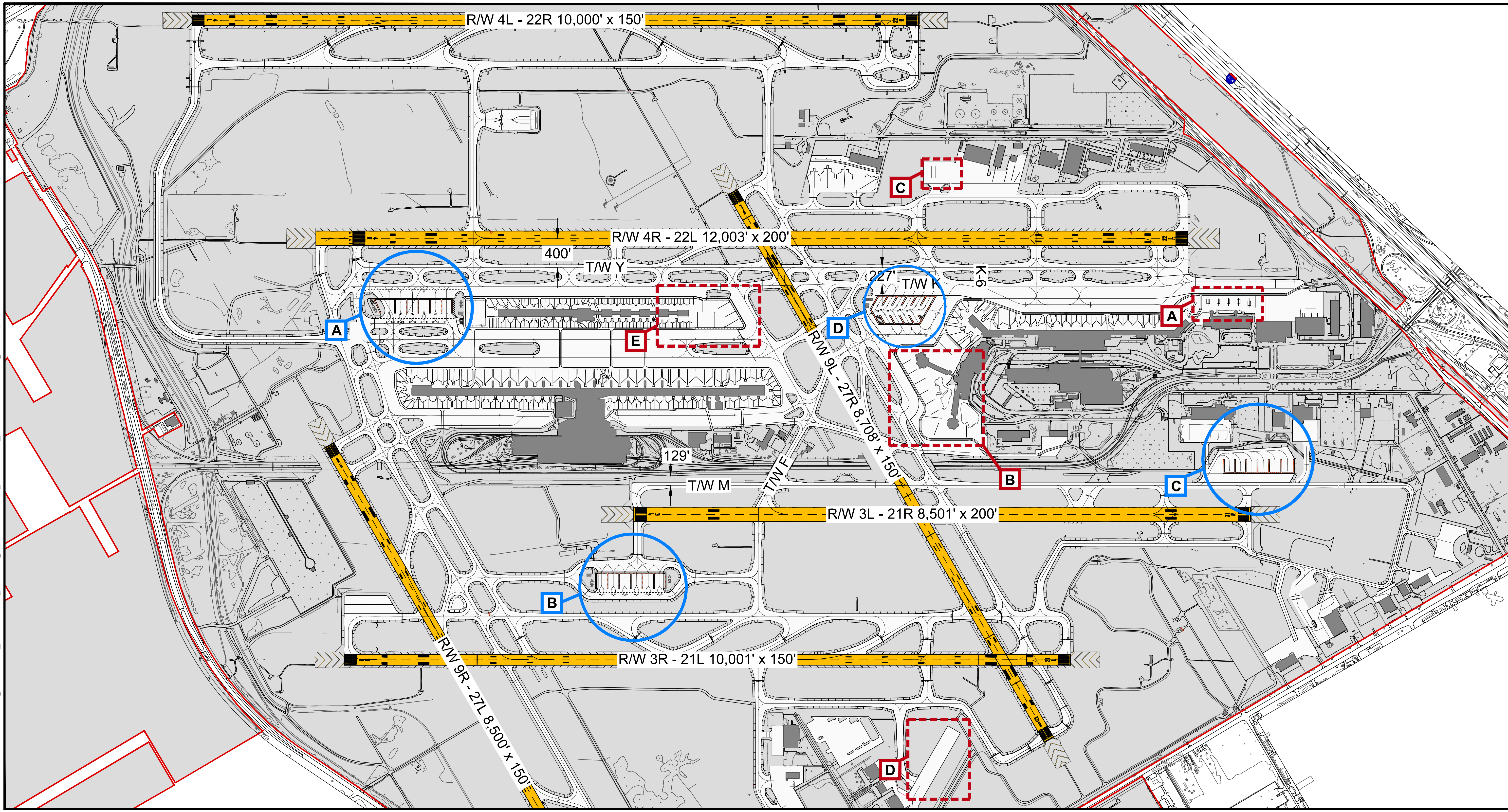
The Airport includes four deicing pads as shown on Figure 4-5. Deicing Pad A is located furthest to the south, primarily serves Delta Air Lines, and can accommodate six narrowbody aircraft or two widebody aircraft. Deicing Pad B is located west of Runway 3L, is also primarily used by Delta Air Lines, and can also accommodate six narrowbody aircraft. Deicing Pad C is located furthest to the north, serves all other airlines, and can accommodate six narrowbody aircraft. Deicing Pad D is located adjacent the North Terminal, serves only regional jet aircraft, and can accommodate 10 aircraft. In total, the deicing pads can accommodate a maximum of 18 narrowbody aircraft and 10 regional jet aircraft. A maximum of 14 narrowbody spots are available if two widebody aircraft are using Deicing Pad A.

4.2.1.5 Deviations from Design Standards

The following identifies Airport-wide geometry deviations from design standards.* Geometric deviations from design standards are depicted on Figure 4-6.

- The Runway 4R-22L centerline to parallel Taxiway Z centerline are separated by 400 feet south of Taxiway Z5. This does not meet standards when weather conditions fall below CAT I conditions, which require 500 feet of separation.
- The Runway 4R-22L centerline to parallel Taxiway Y centerline is separated by 400 feet. This does not meet standards when weather conditions fall below CAT I conditions, which require 500 feet of separation.
- The Taxiway Y centerline to Taxiway K centerline between Runway 9L-27R and Taxiway K6 is separated by 227 feet. This does not meet ADG-V taxiway to taxiway separation standards of 267 feet as required.

*Deviations from design standards under other categories (obstructions, marking and signing) will be determined in later phases of the Master Plan Update and are pending completion of Airports-GIS survey data. Runway Incursion Mitigation (RIM) criteria primarily involve taxiway and runway geometry. RIM criteria, however, are not absolute standards, but rather principles that need to guide future updates of the airfield and need to be evaluated in connection with current and projected operational data.



LEGEND

Runway pavement		Existing building on-airport		Airport property line	
Taxiway / Apron pavement		Fence		R/W	Runway
Other pavement in use		Deicing pad area		T/W	Taxiway
		Remain overnight parking area			

NORTH

0 650' 1300' 2600'

Source: HNTB, March 2016

Figure 4-5
DEICING PAD AND RON PARKING LOCATIONS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

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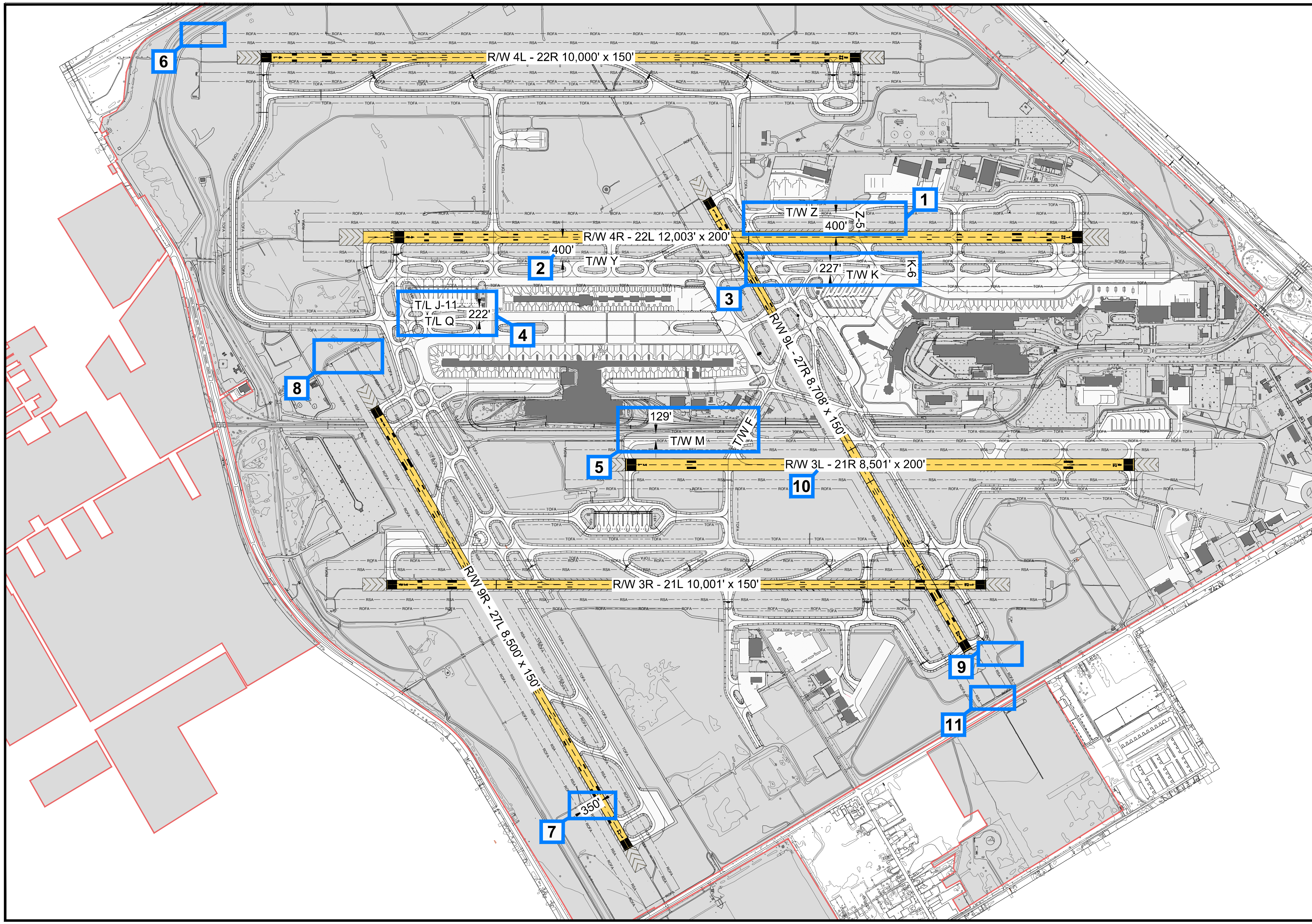

GEOMETRY DEVIATION FROM DESIGN STANDARD DESCRIPTION

1. The Runway 4R-22L centerline and parallel Taxiway Z centerline are separated by 400 feet south of Taxiway Z5. This does not meet standards when weather conditions fall below CAT I conditions, which require 500 feet of separation.

2. The Runway 4R-22L centerline and parallel Taxiway Y centerline are separated by 400 feet. This does not meet standards when weather conditions fall below CAT I conditions, which require 500 feet of separation.

3. The Taxiway Y centerline to Taxiway K centerline between Runway 9L-27R and Taxiway K6 are separated by 227 feet. This does not meet ADG-V taxiway to taxiway separation standards of 267 feet as required.

4. The Taxilane J11 centerline and Taxilane Q centerline are separated by 222 feet. This does not meet the required taxilane to taxilane separation standards of 245 feet.

5. The vehicle service road (VSR) penetrates the Taxiway M Taxiway Object Free Area (TOFA) south of Taxiway F by as much as 31 feet. TOFAs are required to be clear of service roads.

6. The VSR penetrates the Runway 22R Runway Object Free Area (ROFA) beyond the stop end of the runway by 12 feet, reducing the available ROFA beyond the stop end of the runway to 988 feet. This does not meet ROFA clearance standards.

7. The Runway 9R-27L centerline and Runway 27L glideslope antenna are separated by 350 feet. This does not meet standards for runway centerline to glideslope separation.

8. The VSR penetrates the Runway 27L ROFA beyond the stop end of the runway by 74 feet, reducing the available ROFA beyond the stop end of the runway to 926 feet. This does not meet ROFA clearance standards.

9. The VSR penetrates the Runway 9L ROFA beyond the stop end of the runway by 608 feet, reducing the available ROFA beyond the stop end of the runway to 392 feet. This does not meet ROFA clearance standards.

10. Runway 3L-21R does not currently have paved shoulders. 35 foot wide shoulders are required for Runway 3L-21R.

11. The RSA beyond the stop end of Runway 9L is limited by 90 feet. Declared distances are currently applied to the runway to mitigate this non-standard condition.

LEGEND

- RUNWAY PAVEMENT
- TAXIWAY / APRON PAVEMENT
- OTHER PAVEMENT IN USE
- BUILDING - EXISTING - On Airport
- ROFA — RUNWAY OBJECT FREE AREA
- RSA — RUNWAY SAFETY AREA
- TOFA — TAXIWAY OBJECT FREE AREA
- GEOMETRY DEVIATION FROM DESIGN STANDARD
- FENCE
- AIRPORT PROPERTY LINE
- R/W — RUNWAY
- T/L — TAXILANE
- T/W — TAXIWAY

Source: HNTB, March 2016

North

0 900' 1800' 3600'

Figure 4-6

DEVIATIONS FROM DESIGN STANDARDS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
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Leigh | Fisher

- The Taxilane J11 centerline and Taxilane Q centerline are separated by 222 feet. This does not meet the required taxilane to taxilane separation standard of 245 feet.
- The vehicle service road (VSR) penetrates the Taxiway M Taxiway Object Free Area (TOFA) south of Taxiway F by as much as 31 feet. TOFAs are required to be clear of service roads.
- The VSR penetrates the Runway 22R Runway Object Free Area (ROFA) beyond the stop end of the runway by 12 feet, reducing the available ROFA beyond the stop end of the runway to 988 feet. This does not meet ROFA clearance standards.
- The Runway 9R-27L centerline and the Runway 27L glideslope antenna are separated by 350 feet. This does not meet standards for runway centerline to glideslope separation.
- The VSR penetrates the Runway 27L ROFA beyond the stop end of the runway by 74 feet, reducing the available ROFA beyond the stop end of the runway to 926 feet. This does not meet ROFA clearance standards.
- The VSR penetrates the Runway 9L ROFA beyond the stop end of the runway by 608 feet, reducing the available ROFA beyond the stop end of the runway to 392 feet. This does not meet ROFA clearance standards.
- Runway 3L-21R does not currently have paved shoulders. 35-foot wide paved shoulders are required for Runway 3L-21R.
- The RSA beyond the stop end of Runway 9L is 90 feet shorter than required. Declared distances are currently applied to the runway to mitigate this non-standard condition.

4.2.2 Lighting and Navigational Aids

A summary of Airport lighting systems and navigational aids follows.

4.2.2.1 Lighting

The Airport has several different lighting systems to facilitate operations during periods of low visibility or at night. A summary of lighting features for each runway end is presented in Table 4-7. Existing lighting installations include the following:

- **Runway Edge Lighting** – All runways have high intensity runway edge lighting (HIRL). These lights are clear, amber, yellow, red, or green depending on their location on the runway.
- **Runway Centerline Lighting (RCL)** – In-pavement RCLs are installed on precision instrument runways that offer the lowest minima. They are a requirement for CAT II and II runways and for CAT I runways with a Runway Visual Range (RVR) below 2,400 feet. They are spaced every 50 feet along the entire length of the runway. All runways except Runway 9L-27R contain RCLs.
- **Approach Light System (ALS)** – An ALS is installed for runways supporting Instrument Landing System (ILS) CAT I approaches and below. Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) extends 1,400 feet from the runway's arrival threshold. High Intensity Approach Lighting System with Sequenced Flashers (ALSF2) extends 2,400 feet from the runway's threshold. The ALSF2 system is in operation when runway approach visibility falls below one mile.
- **Runway Status Lights (RWSL)** – The RWSLs prevent runway incursions by providing a critical visual queue if the runway is in-use and therefore unsafe for entry or crossing. There are two types of

RWSLs including Takeoff Hold Lights, which are near the end of the runway, and Runway Entrance Lights, which indicate when it is safe to enter or cross a runway.

- **Runway End Identifier Lights (REIL)** – REILs provide synchronized flashing light information to the pilot to assist in acquiring the runway end during approach.
- **Precision Approach Path Indicator (PAPI)** – PAPI is a lighting system that provides decent angle information, and uses a combination of red and white lights, which are only visible at correct or incorrect descent angles.
- **Airport Beacon** – The Airport Beacon is located east of Runway 3R-21L near the general aviation/corporate/charter area. The beacon indicates the approximate location of the Airport to pilots at night.
- **Taxiway Lighting** – All taxiways have high intensity taxiway edge lighting (HITL) and in-pavement Taxiway Centerline Lighting (TCL).

Table 4-7
EXISTING RUNWAY LIGHTING
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Lighting	4L	22R	4R	22L	3R	21L	3L	21R	9L	27R	9R	27L
MALSR		X		X		X				X		X
ALSF2	X		X		X							
PAPI	X	X			X	X	X	X		X		X
REIL						X	X	X	X		X	
HIRL	X	X	X	X	X	X	X	X	X	X	X	X
RCL	X	X	X	X	X	X	X	X			X	X

Source: Alpine Engineering, *Obstruction Survey Report* (2013) and HNTB, February 2016.

4.2.2.2 Navigational Aids

Navigational Aids (NAVAIDS) enhance the wayfinding ability and approach visibility of an airport. NAVAIDs are generally classified into three categories:

- **Precision NAVAIDs** – Include the components of a precision instrument approach: vertical and horizontal instrument guidance. These usually include: glideslope, localizer, precision approach radar, and select Global Positioning Systems (GPS).
- **Non-precision NAVAIDs** – Include GPS, Airport Surveillance Radar 9 (ASR-9), Airport Surveillance Detection Equipment-X (ASDE-X), very high frequency (VHF) omni-directional range (VOR) with or without distance measuring equipment (DME), non-directional beacon (NDB), and tactical air navigation (TAC).
- **Visual NAVAIDs** – Include the airfield lighting features presented in the preceding section.

A summary of the various NAVAIDs is presented in Table 4-8 for each runway end. In addition to runway specific NAVAIDs, the following NAVAIDS are operated Airport-wide: ASR-9, ASDE-X, VOR, VORTAC, and NDB.

Table 4-8
EXISTING NAVAIDS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

NAVAID	4L	22R	4R	22L	3R	21L	3L	21R	9L	27R	9R	27L
DME	X	X	X			X						X
Glide slope *(a)*	X	X	X	X	X	X				X		X
Localizer	X	X	X	X	X	X				X		X
Offset localizer	X	X										
Runway Visual Range	X	X	X	X	X					X		X
Inner Marker Beacons	X		X		X							

(a) Runway 4L-22R includes a Glide Slope to the left and right.

Source: Alpine Engineering, *Obstruction Survey Report* (2013) and HNTB, February 2016.

4.2.2.3 Instrument Procedures

Precision instrument approach procedures allow aircraft operations during periods of low visibility. A precision approach utilizes ground- or satellite-based navigational aids to provide pilots with definitive guidance on the horizontal and vertical position of the aircraft. There are 37 existing instrument approach procedures published by the FAA for the Airport. Approaches include:

- **CAT I ILS** – In inclement weather conditions, the ILS system allows a pilot to ascertain the orientation of the aircraft relative to runway centerline as well as angle of approach to the runway. Runways 3R, 4R, 4L, 21L, 22R, 22L, 27R, and 27L are equipped with these procedures. Special Authorized (SA) CAT I ILS procedures offer improved landing minima over a standards ILS system. FAA Order 8400.13D explains the ground equipment requirements to be eligible for approaches as low as RVR 1,400 feet and a decision height of 150 feet. These requirements include, but are not limited to, minimum runway length, use of certain NAVAIDs, commissioned glide path angle of 3.0 degrees, maximum threshold crossing height of 60 feet, etc. Runways 3R, 4R, 21L, 22L, 27L, and 22R are equipped with these procedures.

- **CAT II ILS** – These approaches are eligible for minimums as low as RVR 1,200 feet and a decision height of 100 feet. Runways 3R, 4R, and 4L are equipped with these procedures. SA CAT II ILS procedures are similar to standard CAT II procedures in that they offer minimums as low as RVR 1,200 feet and a decision height of 100 feet. However, they do not require the same amount of ground equipment infrastructure as does a standard CAT II ILS. Runways 21L, 22L, 27L, and 22R are equipped with these procedures.

- **CAT III ILS** – These approaches offer the best possible minimums as low as RVR 300 feet without a decision height and can provide guidance all the way to the ground. FAA Order 8400.13D explains the ground equipment requirements, operational requirements, and specific approvals needed. Runways 3R, 4R, and 4L are equipped with these procedures.

- **PRM ILS** – Precision Runway Monitor (PRM) permits simultaneous arrivals between closely spaced parallel runways. The separation distance must be at least 3,400 feet. The distance between Runway 4L-22R and Runway 4R-22L is 3,000 feet and therefore Runways 4L and Runway 22R offer an offset course to allow adequate spacing for three simultaneous arrivals to Runways 4L, 4R, and 3R in north flow and Runways 21L, 22L, and 22R in south flow.

- **Area Navigation (RNAV [GPS])** – Runways 3R, 4R, 4L, 21L, 22L, 22R, 27L, and 27R have RNAV approaches that utilize pre-determined waypoints and global positioning system (GPS) guidance to enable aircraft to fly point-to-point until reaching the runway.

4.2.3 Airfield Operations

The operational configuration of the Airport's runway and taxiway system is primarily dictated by the prevailing wind and weather conditions.

4.2.3.1 Runway Use Configuration

The Airport primarily operates under one of two runway use configurations.

- **South Flow** – South flow is characterized by all takeoffs and landings from the north towards the south using Runways 22R, 22L, 21R, and 21L. In south flow, Runways 22R and 21L are primarily used as arrival runways with Runways 22L and 21R used as departure runways. South flow is the preferred runway use configuration and is typically in effect up to a tailwind of 5 to 10 knots.

- **North Flow** – North flow is characterized by all takeoffs and landings from the south towards the north using Runways 4L, 4R, 3L, and 3R. In north flow, Runways 4L and 3R are primarily used as arrival runways with Runways 4R and 3L used as departure runways.

Crosswind Runways 9L-27R and 9R-27L are used sparingly and typically only when the crosswind component for north or south flow exceeds 20 knots.

During heavy arrival periods, the Airport can operate with three simultaneous arrival streams making use of Runway 4L-22R, 4R-22L, and 3R-21L. The three simultaneous independent approaches can be conducted in both visual flight rules (VFR) using visual approaches and instrument flight rules (IFR) conditions when the PRM is in use.

Average runway use configuration utilization percentages were identified in the Airport's Federal Aviation Regulations Part 150 study, which was completed in 2006. South flow is the predominant runway use configuration, with approximately 68% annual utilization. North flow averages approximately 31% annual utilization. West and east flows on the crosswind runways are used less than 1% of the time. Table 4-9 presents specific runway utilization for day and nighttime operations.

Table 4-9
RUNWAY UTILIZATION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

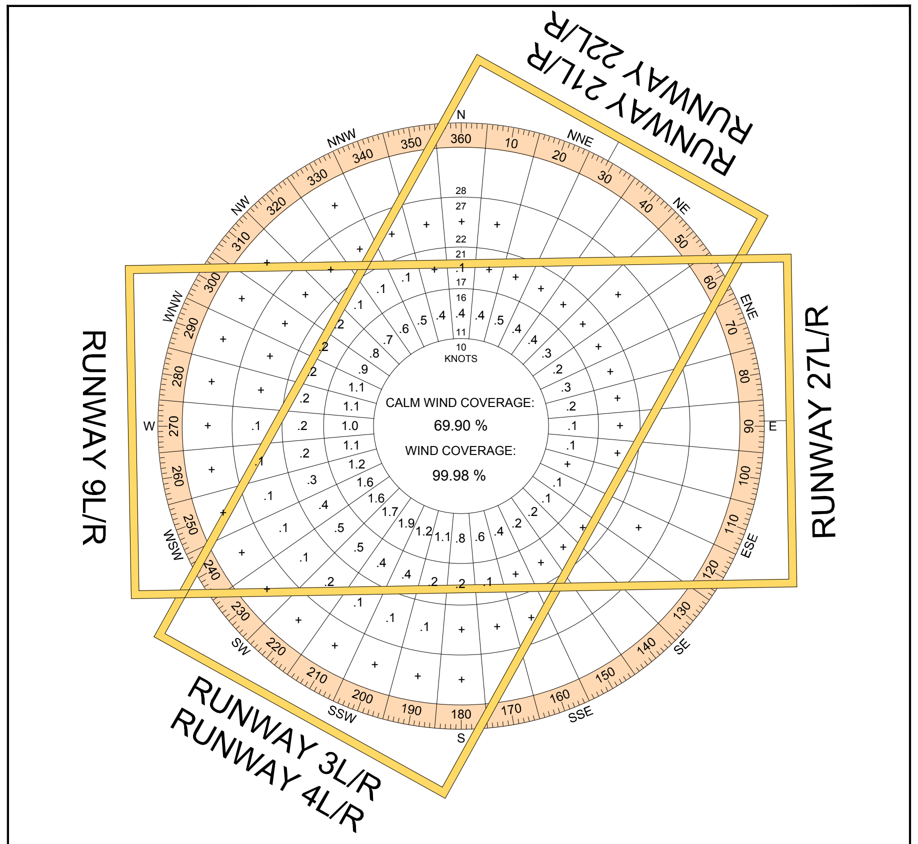
Runway	Flow	Location	Arrival daytime	Arrival nighttime	Departure daytime	Departure nighttime
4L	North	West Outboard	14%	13%	0%	0%
22R	South	West Outboard	32	36	1	1
4R	North	West Inboard	3	4	15	15
22L	South	West Inboard	9	11	31	32
3L	North	East Inboard	1	1	15	15
21R	South	East Inboard	4	4	34	33
3R	North	East Outboard	12	11	1	1
21L	South	East Outboard	23	18	1	1
9L	East	North Runway	<1	<1	<1	<1
27R	West	North Runway	<1	<1	<1	<1
9R	East	South Runway	<1	<1	<1	<1
27L	West	South Runway	<1	<1	<1	<1

Source: BridgeNet International and HNTB, February 2016.

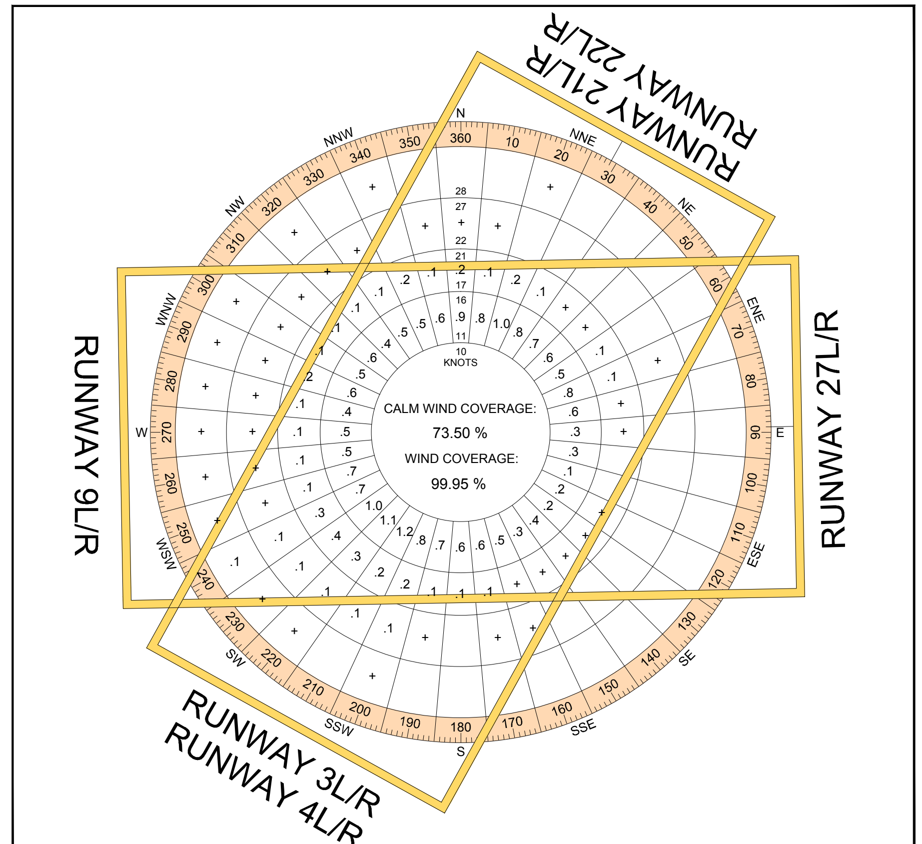
Figure 4-7 presents the Airport's all-weather wind coverage diagram based on 75,020 observations from the National Oceanographic and Atmospheric Administration's National Climactic Data Center between January 2006 and January 2016.

Wind coverage data are shown in Table 4-10 for all runways, north and south flow, and east and west flow, respectively. Under VFR, the runways cover 99.98% of historical wind observations; under IFR, the runways cover 99.95% of historical wind observations. Under both VFR and IFR, the runways cover 99.97% of historical wind observations. As shown, the existing runway network is oriented to best maximize prevailing wind coverage and minimize cross-wind components. Calm wind coverage allows for a runway operating condition that enables maximum flexibility and operating capacity. During all weather conditions, calm winds (when wind velocities are less than 3 knots) occur approximately 71% of the time. Instrument meteorological conditions (IMC) occur approximately 19.77% of the year.

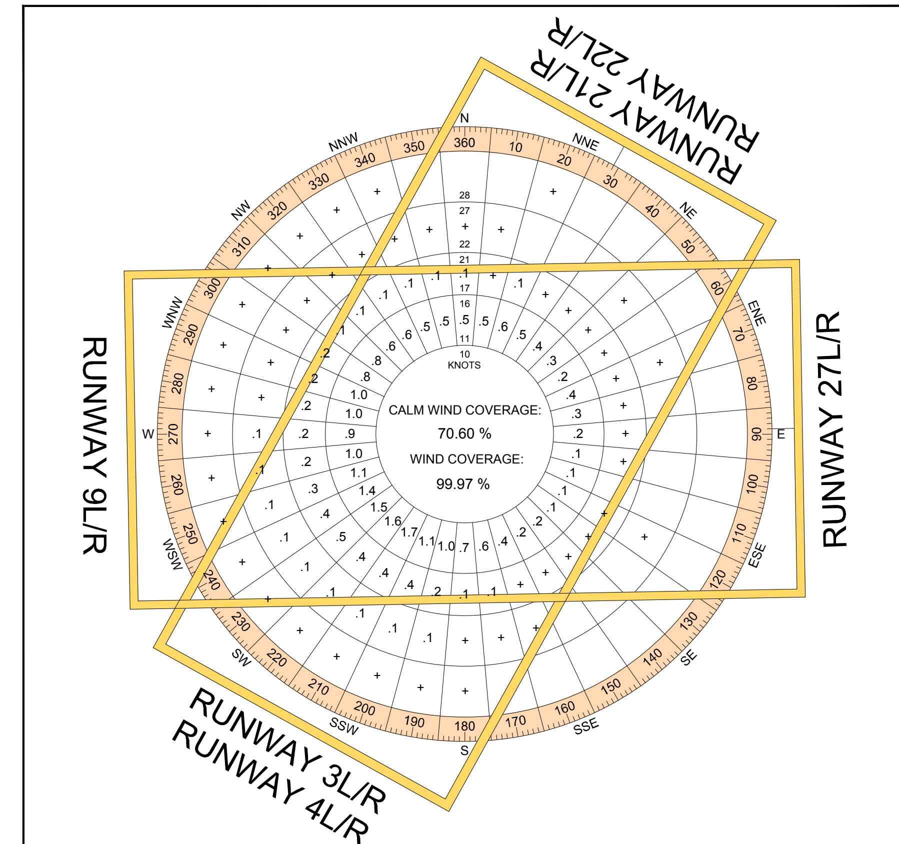
VFR WIND ROSE	IFR WIND ROSE	ALL WEATHER WIND ROSE



20 Knot Wind Rose - ARC: D-V



20 Knot Wind Rose - ARC: D-V



20 Knot Wind Rose - ARC: D-V

Figure 4-7

WIND ROSES AND WIND COVERAGE

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

Source: HNTB, March 2016

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Table 4-10
WIND COVERAGE SUMMARY
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Crosswind component	VFR coverage	IFR coverage	All weather coverage
	All Runways		
10.5 knots	97.30%	97.12%	97.26%
13 knots	99.24%	99.06%	99.21%
16 knots	99.82%	99.77%	99.81%
20 knots	99.98%	99.95%	99.97%
	North and South Flow		
10.5 knots	89.36%	91.45%	89.78%
13 knots	94.22%	95.53%	94.48%
16 knots	98.20%	98.54%	98.27%
20 knots	99.51%	99.59%	99.52%
	West and East Flow		
10.5 knots	86.09%	86.19%	86.11%
13 knots	92.44%	92.27%	92.41%
16 knots	97.58%	97.56%	97.58%
20 knots	99.33%	99.40%	99.35%

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center and HNTB, February 2016.

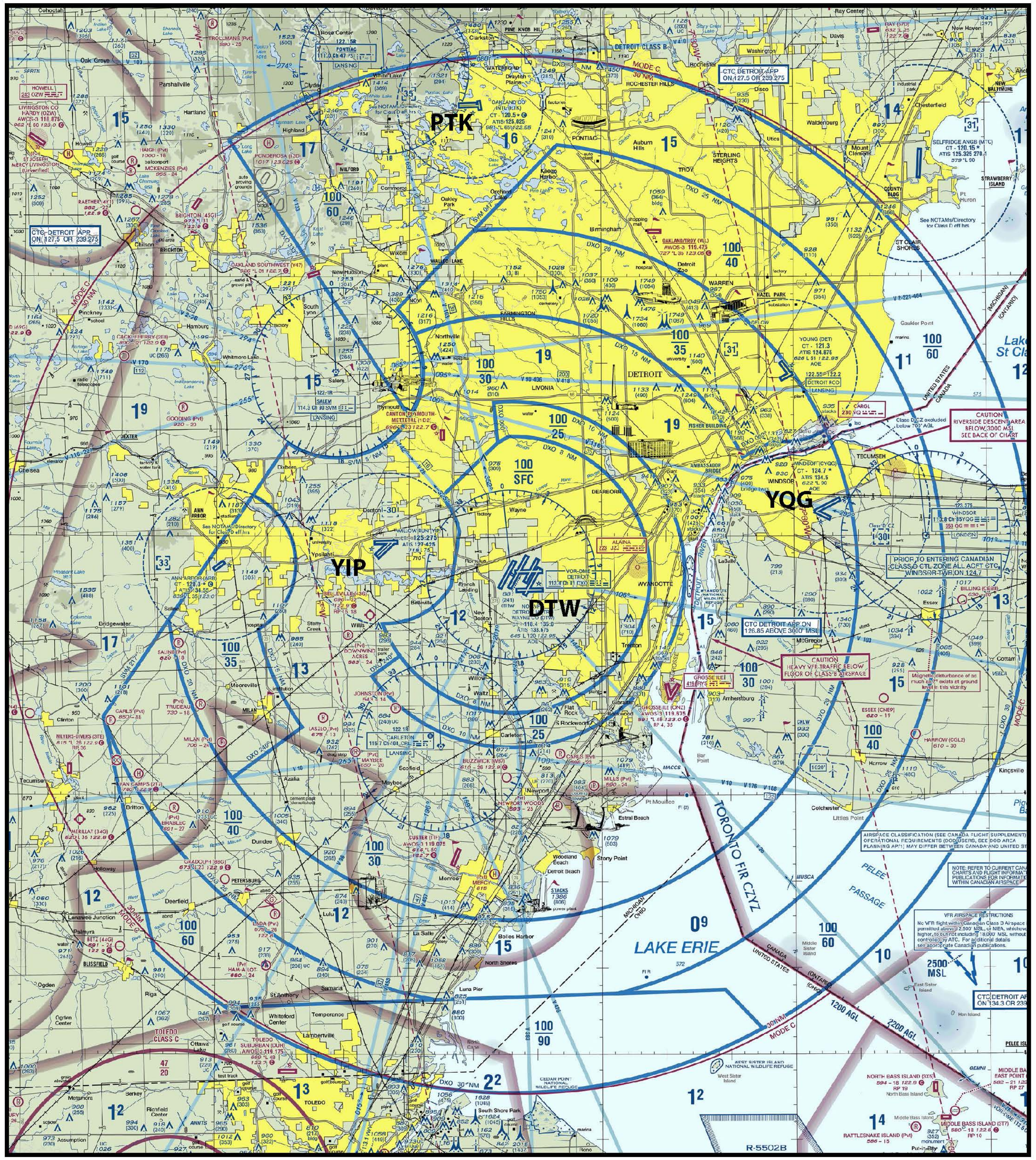
4.2.4 Airspace and Air Traffic Control

This section describes airspace and air traffic control (ATC) provisions that affect aircraft operations and includes descriptions of airspace procedures, air traffic control jurisdictions, and obstructions affecting navigable airspace.

4.2.4.1 Airspace Structure

The National Airspace System (NAS) is the network of U.S. airspace, which includes navigation facilities, equipment, procedures, airports, and air traffic controllers. The NAS consists of six, 3-dimensional classes of airspace (A, B, C, D, E, and G) that differ based on flight rules and level of interaction with ATC.

Figure 4-8 depicts the existing sectional chart for Detroit. The classification of airspace above the Airport is Class B, which is also referred to as a terminal control area. Class B airspace exists from the ground to 10,000 feet above mean sea level. This airspace is individually designed for each airport and consists of a surface area and two or more layers of controlled airspace. Operations under both VFR and IFR are permitted as long as ATC clearance has been received.



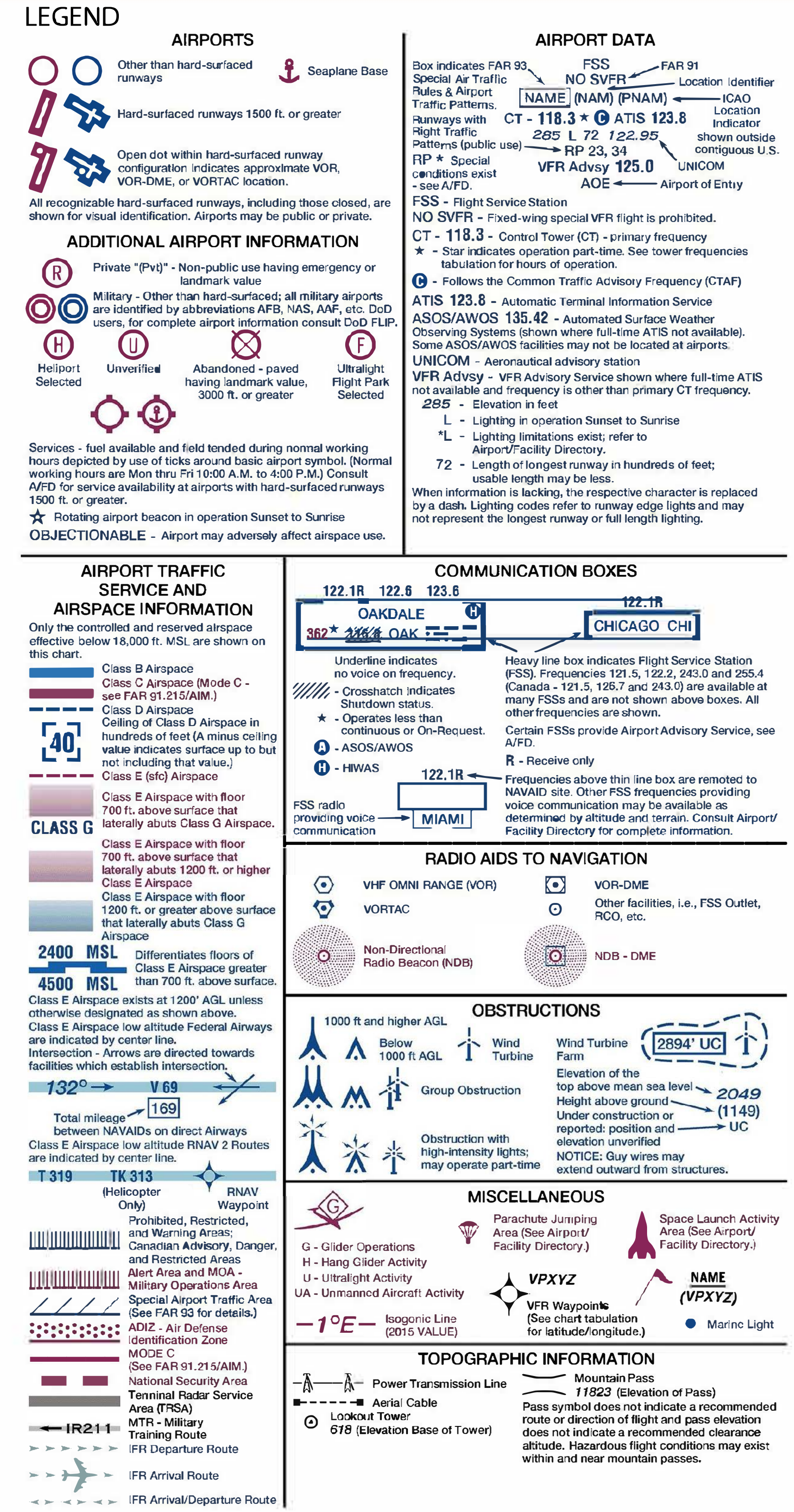


Figure 4-8
DETROIT VFR TERMINAL AREA CHART

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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The major airspace structure has not changed significantly since the last Airport master plan was completed. However, a major redesign of the airspace is now underway to take advantage of the benefits that will be provided by the NextGen Air Traffic Management System, which is the updated system for ATC that is being incorporated into the NAS. The official program that will affect the Airport's airspace is called the DTW-CLE Metroplex; the intent of this program is to improve the efficiency of the regional airspace while minimizing impacts to surrounding communities

4.2.4.2 Air Traffic Control Jurisdictions

Airspace in the Detroit area falls under the jurisdiction of the following entities: the Cleveland Air Route Traffic Control Center (ARTCC), Detroit Terminal Radar Approach Control (TRACON), and Detroit ATCT.

- **Cleveland ARTCC** – The airspace over the continental U.S. is divided into 20 geographically defined ATC jurisdictions based on ARTCCs, which provide radar service and other ATC services to en route aircraft (i.e., those aircraft that are not landing or taking off). The Cleveland ARTCC has jurisdiction of en route traffic over portions of Maryland, Michigan, New York, Ohio, Pennsylvania, West Virginia, as well as the southernmost portion of Ontario, Canada.

- **Detroit TRACON** – The TRACON provides radar approach and departure control as well as other ATC services to aircraft flying in terminal area airspace. Detroit Center has delegated control over certain airspace in the Detroit area to the Detroit TRACON, located at the Airport.

- **FAA ATCT** – The ATCT provides air traffic control services to aircraft at and in the immediate vicinity of an airport, ensuring the safe, orderly, and expeditious flow of traffic. Controllers are responsible for separating aircraft on the ground and in the traffic pattern, giving arrival and departure clearances, and providing weather information to pilots. The ATCT at Detroit is located along the Airport's primary entrance road to the north of the passenger terminal.

4.3 PASSENGER TERMINAL COMPLEX

The Airport passenger terminal complex is comprised of two terminals – the Edward H. McNamara Terminal, located on the south side of the Airport; and the North Terminal, located on the north side. The passenger terminal complex is depicted on Figure 4-2, and occupies approximately 139 acres.

The total area within the McNamara and North terminals is summarized in Table 4-11. The following sections provide a description of the terminal buildings and concourses and the various passenger processing functions.

4.3.1 McNamara Terminal

The Edward H. McNamara terminal was opened in February 2002. The terminal was originally constructed to serve as a hub for Northwest Airlines, but is now used exclusively by Delta Air Lines and its SkyTeam Alliance partners. At the time of its opening, the terminal and concourses provided 97 aircraft gates and an adjacent Westin Hotel directly connected to the terminal. The one mile long Concourse A was the first in a U.S. airport with an indoor tram that traverses the length of the concourse. Concourses B and C are located in the midfield with an underground tunnel for connection with Concourse A. In 2005, Concourses B and C were expanded to accommodate increased service raising the aircraft gate total to 122 gates.

Table 4-11
PASSENGER TERMINAL GROSS AREA (SQ FT)
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Lower level	Level 1	Level 2	Level 3	Total
Terminals					
McNamara	207,600	150,500	136,900	121,500	616,500
North	81,000	199,900	133,000	0	413,900
Total	288,600	350,400	269,900	121,500	1,030,400
Concourses					
McNamara					
Concourse A	166,300	480,500	542,600	73,900	1,263,300
Concourse B	68,600	87,100	92,000	0	247,700
Concourse C	0	77,100	74,900	0	152,000
North					
Concourse D	65,500	208,900	234,800	0	509,200
Total	300,400	853,600	944,300	73,900	2,172,200
Grand total	589,000	1,204,000	1,214,200	195,400	3,202,600

Notes: Calculations based on gross areas measured to the outside edge of exterior walls, rounded to the nearest hundred square feet.
Concourses A, B, and C are associated with the McNamara Terminal.

Source: LeighFisher, based on terminal drawings provided by Wayne County Airport Authority, February 2016.

4.3.1.1 Terminal Processor

The terminal processor provides approximately 600,000 square feet of space on four levels:

- Lower Level – International Arrivals
- Level 1 – Domestic Arrivals
- Level 2 – Concourse
- Level 3 – Departures

Table 4-12 summarizes the space allocation within the McNamara Terminal. Terminal floor plans for all levels of the McNamara Terminal are depicted on Figures 4-9 through 4-12.

The Lower Level contains the Federal Inspection Services (FIS), customs facility, and international passenger baggage claim. It also contains offices for Customs and Border Protection, as well as airline support space, and security recheck for connecting passengers.

Table 4-12
McNAMARA TERMINAL PROCESSOR SPACE ALLOCATION (SQ FT)
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Space category	Lower level	Level 1	Level 2	Level 3	Total
Airline space *(a)*	0	356,700	268,800	50,000	675,500
Airport administration	99,000	21,500	15,800	22,500	158,800
Baggage claim	71,600	56,000	0	0	127,600
Baggage handling	0	170,800	0	0	170,800
Concessions	1,700	17,000	133,800	0	152,500
Customs and immigration *(b)*	176,600	0	0	0	176,600
Open/vacant	0	0	0	0	0
Other *(c)*	32,500	120,200	128,900	61,200	342,800
Public space	59,400	21,800	292,000	51,800	425,000
Security screening *(d)*	1,700	31,200	7,100	9,900	49,900
Total	442,500	747,700	846,400	195,300	2,279,500

Note: Calculations based on gross areas measured to the outside edge of exterior walls and the center of interior walls, rounded to the nearest hundred square feet.

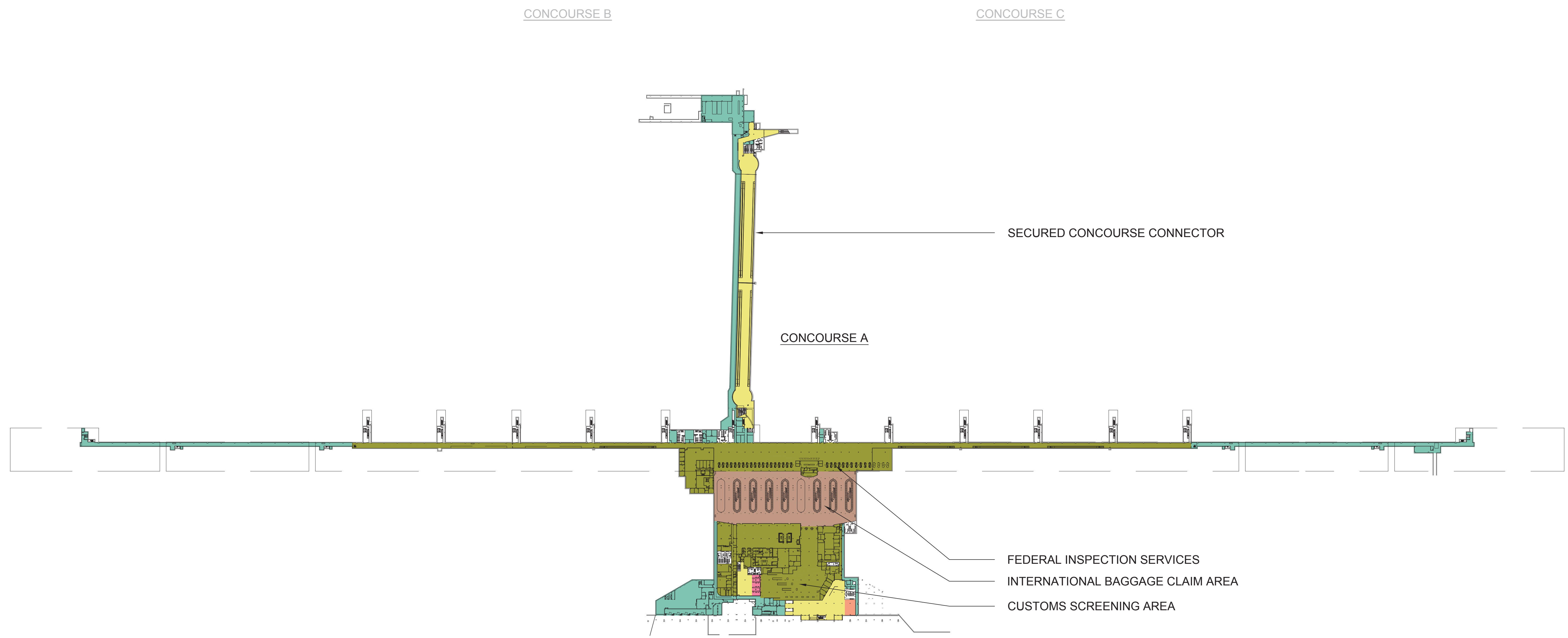
(a) Includes ticket counters, operations space, departure lounges, and secure office space.
(b) Includes all space allocated for the Federal Inspection Services.
(c) Includes building systems, utilities, and other non-leased spaces within the building.
(d) Includes TSA-leased space within the terminal building.

Source: LeighFisher, based on terminal drawings provided by Wayne County Airport Authority, February 2016.

Level 1 contains domestic passenger baggage claims and the baggage handling and sorting areas used by airline personnel. Additionally, there are airline office spaces adjacent to the claim areas to support passenger luggage retrieval.

Level 2 contains a centrally located TSA passenger security screening checkpoint (SSCP), the bridge connection to the McNamara Garage and Ground Transportation Center, airline and Airport support space, and secure area concessions. A ten-level pubic parking garage connects to the terminal on the Level 2.

Level 3 contains ticket counter check-in positions, airline electronic kiosks for passenger check-in, airline office space, two SSCPs (located one each on the north and south sides of the processor), a Delta Air Lines Sky Club lounge, and building mechanical rooms. There is also a connection to the Westin Hotel.



LEGEND

- Public circulation
- Concessions
- Security screening checkpoint
- Baggage claim area
- Customs and Border Protection
- Airport support

NORTH

0 160' 320' 640'

Source: Wayne County Airport Authority

Figure 4-9

OVERALL - LOWER LEVEL
McNAMARA TERMINAL

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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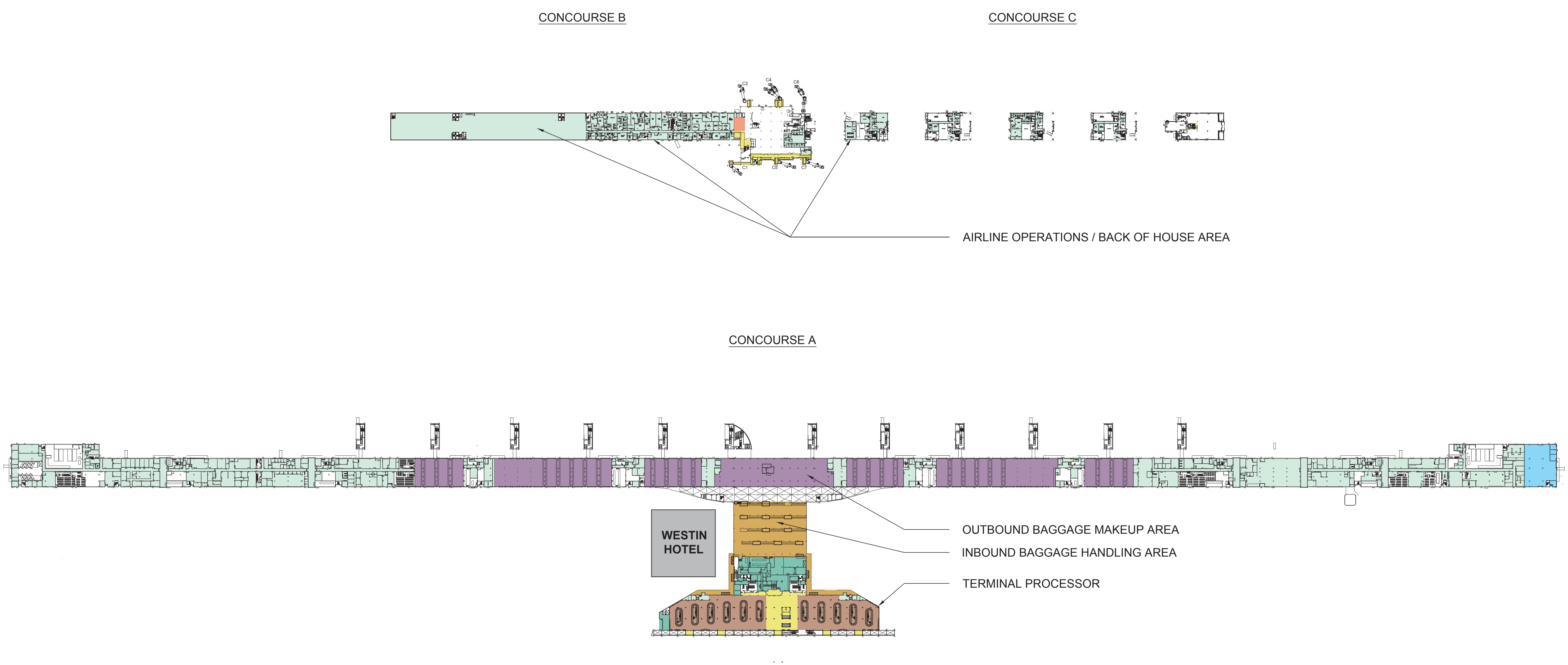

LEGEND

- Public circulation
- Concessions
- Baggage claim area
- Airport support
- BSO / Airline support
- Miscellaneous / Others
- Outbound baggage makeup area
- Inbound baggage delivery area

NORTH

0 160' 320' 640'

Source: Wayne County Airport Authority

Figure 4-10

OVERALL - LEVEL 1
McNAMARA TERMINAL

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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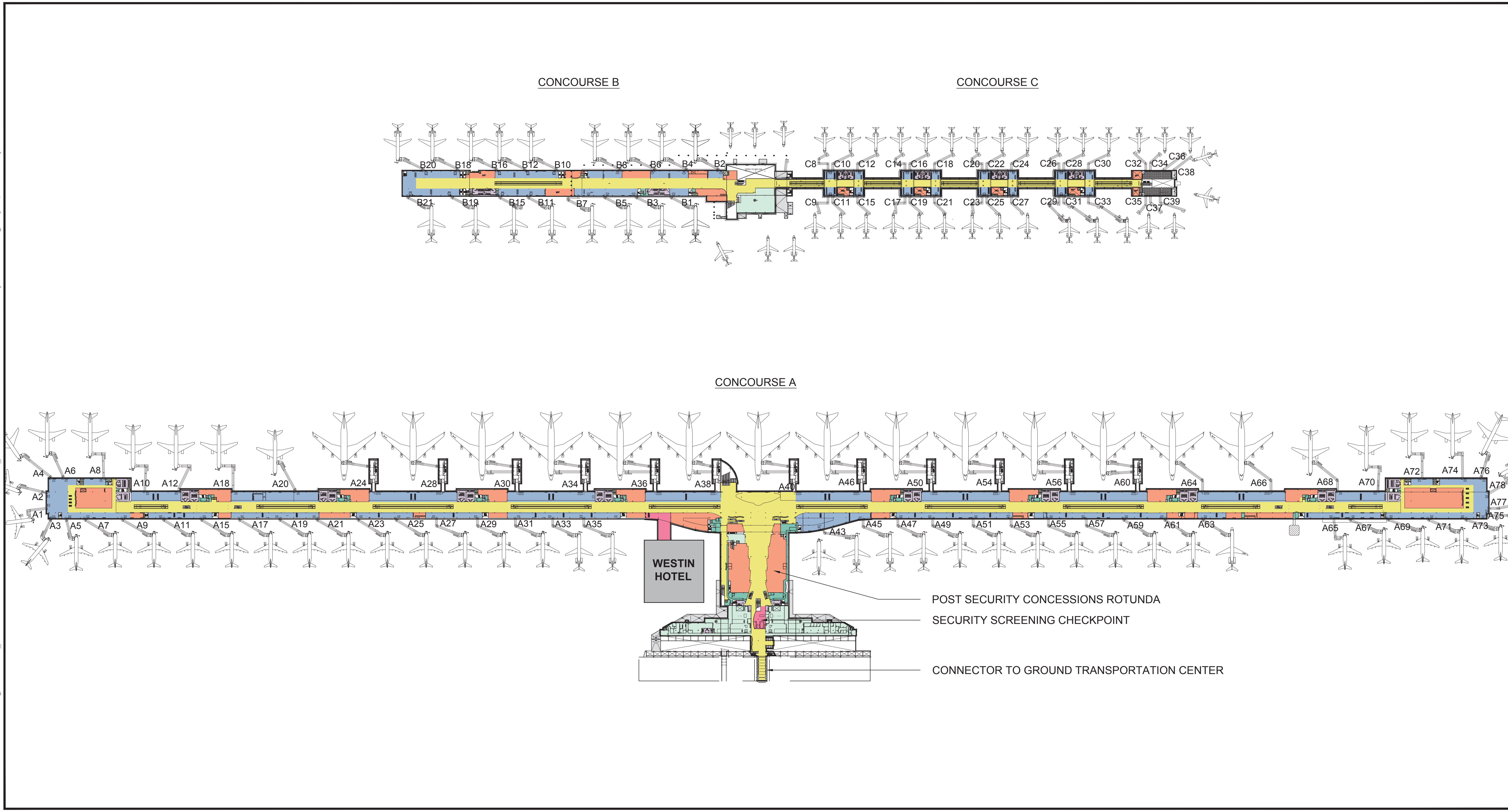

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LEGEND

- Public circulation
- Holdrooms
- Concessions
- Security screening checkpoint
- Airport support
- BSO / Airline support

Source: Wayne County Airport Authority

Figure 4-11

OVERALL - LEVEL 2
McNAMARA TERMINAL

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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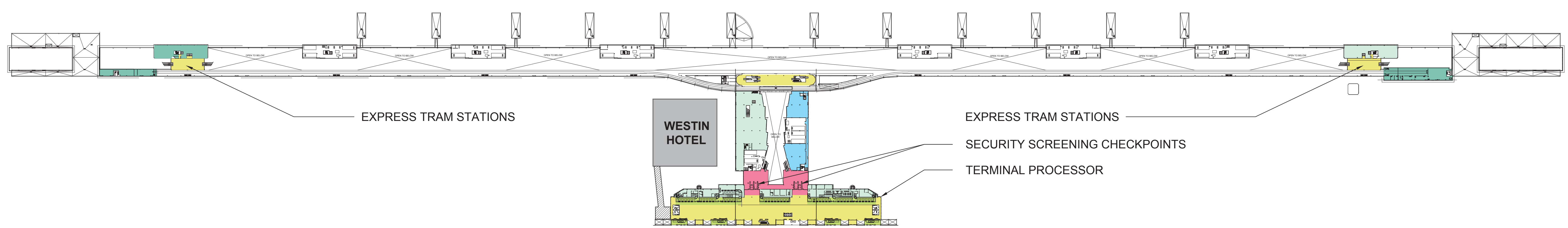

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LEGEND

- Public circulation
- Security screening checkpoint
- Ticketing / Airline ticket office
- Airport support
- BSO / Airline support
- Miscellaneous / Others

NORTH

0 160' 320' 640'

Source: Wayne County Airport Authority

Figure 4-12
OVERALL - LEVEL 3
McNAMARA TERMINAL

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

Leigh|Fisher

4.3.1.1.1 Baggage

Domestic baggage claim facilities are located on Level 1 of the terminal processor. There are 11 carousel claim devices in use by Delta Air Lines. International baggage claim facilities are located on the Lower Level of the terminal. There are seven carousel claim devices to serve international arriving flights. Inbound and outbound baggage make-up facilities, in which airline personnel transfer baggage to and from conveyor belt systems onto carts to be transported directly to aircraft, are located on the same level as the domestic claim devices. Baggage originating at the ticketing facilities on Level 3 is transported downstairs via conveyor belt onto baggage carousels or laterals, around which carts are staged and manually loaded.

4.3.1.1.2 Ticketing

There is a ticketing lobby on Level 3 providing positions for airline agents and electronic kiosks to support the checking-in of airline passengers and baggage. In total, there are 81 positions allocated to individual airlines on an exclusive-use basis. The location and number of positions occupied by each airline are summarized in Table 4-13.

Table 4-13
McNAMARA TERMINAL AIRLINE TICKETING POSITIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Airline	Agent positions	Kiosk positions *(a)*	Curbside positions	Total
Air France	8	0	0	8
Delta Air Lines *(b)*	69	49	4	122
Virgin Atlantic	7	0	0	7

(a) Includes kiosks located at both the ticket counter as well as remotely in lobby for passengers not checking baggage.
(b) Eight agent positions and four kiosk positions are located in the McNamara Garage.

Source: LeighFisher field verification, February 2016.

4.3.1.1.3 Passenger Security Screening Checkpoints

There are five passenger SSCPs, which provide metal detector and x-ray screening of passenger and baggage to facilitate access to the secure concourse areas. Two checkpoints are located on Level 3 adjacent to airline ticketing, one is located on Level 2 across from the bridge, one is located on the lower level at the exit to the FIS to serve international arrivals connecting to domestic flights, and one is located in the Westin Hotel. For originating passengers, there are 11 checkpoint lanes: four on the north side of Level 3, four on the south side of Level 3, two on Level 2, and one in the Westin Hotel. The Westin Hotel security checkpoint also provides access for Known Crewmembers.

4.3.1.1.4 Federal Inspection Services Facility

Centrally located in the terminal processor, the FIS facility is directly connected to sterile corridors serving 12 frontal gates at Concourse A, which occupies approximately 180,000 square feet on the Lower Level. The FIS provides immigration processing for passengers arriving from abroad, and includes baggage claim devices, customs screening, office space for the U.S. Customs and Border Protection, and a SSCP for passengers who are connecting to a domestic flight. Once arriving passengers and their bags have been processed, an escalator transports connecting passengers to Level 2 – Concourse adjacent to Gate A38.

4.3.1.2 Passenger Concourses

The McNamara Terminal's three passenger concourses – Concourses A, B, and C – together provide 120 gates available for active loading and unloading of passengers, baggage, and belly cargo. Concourse A and Concourse B/C are oriented linear in a north-south orientation to the terminal processor, with Concourse A attached to the terminal processor. Concourse B/C is a midfield satellite concourse connected via tunnel from Concourse A, with Concourse B extending southward and Concourse C extending northward. All concourses are double-loaded (gates on both sides of the building), except for the portion of Concourse A adjacent to the terminal processor.

Concourse A has four levels: a lower level used for transporting international arriving passengers from aircraft to the FIS; an apron level, the majority of which is used by airline tenants; a passenger level containing passenger gates, departure lounges, concessions, and restrooms; and a mezzanine level containing the Express Train and airline club rooms.

Concourses B and C have two levels: an apron level, the majority of which is used by airline tenants, and a passenger level containing passenger gates, departure lounges, concessions, and restrooms. In total, the three concourses at McNamara provide approximately 1,663,000 square feet of usable space.

Delta Air Lines occupies all 63 gates on Concourse A and 41 gates on Concourses B and C. Sixteen gates on Concourse C are currently not in-use. SkyTeam Alliance partners have access to the FIS equipped gates on Concourse A, with Virgin Atlantic primarily using gate A-46 and Air France primarily using gate A-56. A summary of airline gate assignments and aircraft parking capabilities is provided in Table 4-14.

4.3.2 North Terminal

The North Terminal opened for operation in September 2008 and accommodates all airlines not affiliated with SkyTeam. It was constructed to replace the Berry and Smith Terminals.

4.3.2.1 Terminal Processor

The terminal processor provides approximately 413,900 square feet of space on three levels:

- Tunnel Level
- Lower Level
- Upper Level

A six-level terminal parking garage connects to the terminal building on the mezzanine level, which is accessed from the Upper Level. Table 4-15 summarizes space allocation for the North Terminal. Terminal floor plans for the lower and upper levels of the North Terminal are depicted on Figures 4-13 and 4-14. The Tunnel Level is not open for public access and is primarily used for Airport support and utility/maintenance access.

Table 4-14
SUMMARY OF PASSENGER GATES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Gate	Airline *(a)*	Gate type	Largest aircraft	Notes
<u>**McNamara Terminal**</u>				
Concourse A				
A1	Delta Air Lines	Bridge	A-320	
A2	Delta Air Lines	Bridge	A-320	
A3	Delta Air Lines	Bridge	A-320	
A4	Delta Air Lines	Bridge	737-800	
A5	Delta Air Lines	Bridge	A-320	
A6	Delta Air Lines	Bridge	757-200	
A7	Delta Air Lines	Bridge	737-900	
A8	Delta Air Lines	Bridge	757-200	
A9	Delta Air Lines	Bridge	727-200	
A10	Delta Air Lines	Bridge	757-200	
A11	Delta Air Lines	Bridge	A-319	
A12	Delta Air Lines	Bridge	757-200	
A15	Delta Air Lines	Bridge	A-320	
A17	Delta Air Lines	Bridge	727-200	
A18	Delta Air Lines	Bridge	757-200	
A19	Delta Air Lines	Bridge	727-200	
A20	Delta Air Lines	Bridge	757-200	
A21	Delta Air Lines	Bridge	727-200	
A23	Delta Air Lines	Bridge	727-200	
A24	Delta Air Lines	Bridge, dual	747-400	FIS access
A25	Delta Air Lines	Bridge	A-320	
A27	Delta Air Lines	Bridge	A-320	
A28	Delta Air Lines	Bridge, dual	747-400	FIS access
A29	Delta Air Lines	Bridge	A-320	
A30	Delta Air Lines	Bridge, dual	747-400	FIS access
A31	Delta Air Lines	Bridge	A-320	
A33	Delta Air Lines	Bridge	717-200	
A34	Delta Air Lines	Bridge, dual	747-400	FIS access
A35	Delta Air Lines	Bridge	EMB-175	
A36	Delta Air Lines	Bridge, dual	747-400	FIS access
A38	Delta Air Lines	Bridge, dual	747-400	FIS access
A40	Delta Air Lines	Bridge, dual	EMB-175	FIS access
A43	Delta Air Lines	Bridge	717-200	
A45	Delta Air Lines	Bridge	MD-80	
A46	Delta Air Lines	Bridge, dual	747-400	FIS access (Virgin Atlantic)
A47	Delta Air Lines	Bridge	EMB-175	
A49	Delta Air Lines	Bridge	A-320	
A50	Delta Air Lines	Bridge, dual	747-400	FIS access
A51	Delta Air Lines	Bridge	A-320	
A53	Delta Air Lines	Bridge	A-320	
A54	Delta Air Lines	Bridge, dual	747-400	FIS access
A55	Delta Air Lines	Bridge	A-320	

Table 4-14 *(continued)*
SUMMARY OF PASSENGER GATES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Gate	Airline *(a)*	Gate type	Largest aircraft	Notes
Concourse A *(continued)*				
A56	Delta Air Lines	Bridge, dual	747-400	FIS access (Air France)
A57	Delta Air Lines	Bridge	A-320	
A59	Delta Air Lines	Bridge	A-320	
A60	Delta Air Lines	Bridge, dual	747-400	FIS access
A61	Delta Air Lines	Bridge	A-320	
A63	Delta Air Lines	Bridge	727-200	
A64	Delta Air Lines	Bridge	747-400	
A65	Delta Air Lines	Bridge	A-320	
A66	Delta Air Lines	Bridge	747-400	
A67	Delta Air Lines	Bridge	A-320	
A68	Delta Air Lines	Bridge	757-200	
A69	Delta Air Lines	Bridge	A-320	
A70	Delta Air Lines	Bridge	757-200	
A71	Delta Air Lines	Bridge	A-320	
A72	Delta Air Lines	Bridge	757-200	
A73	Delta Air Lines	Bridge	A-320	
A74	Delta Air Lines	Bridge	757-200	
A75	Delta Air Lines	Bridge	A-320	
A76	Delta Air Lines	Bridge	757-200	
A77	Delta Air Lines	Bridge	A-320	
A78	Delta Air Lines	Bridge	A-320	
Concourse B				
B1	Delta Air Lines	Bridge	EMB-175	
B2	Delta Air Lines	Bridge	EMB-175	
B3	Delta Air Lines	Bridge	EMB-175	
B4	Delta Air Lines	Bridge	EMB-175	
B5	Delta Air Lines	Bridge	737-900	
B6	Delta Air Lines	Bridge	EMB-175	
B7	Delta Air Lines	Bridge	EMB-175	
B8	Delta Air Lines	Bridge	737-800	
B10	Delta Air Lines	Bridge	EMB-175	
B11	Delta Air Lines	Bridge	A-319	
B12	Delta Air Lines	Bridge	A-319	
B15	Delta Air Lines	Bridge	A-319	
B16	Delta Air Lines	Bridge	A-320	
B18	Delta Air Lines	Bridge	A-320	
B19	Delta Air Lines	Bridge	A-320	
B20	Delta Air Lines	Bridge	EMB-175	
B21	Delta Air Lines	Bridge	A-320	

Table 4-14 *(continued)*
SUMMARY OF PASSENGER GATES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Gate	Airline *(a)*	Gate type	Largest aircraft	Notes
Concourse C				
C1	Delta Air Lines	Bridge	CRJ-200	
C2	Delta Air Lines	Bridge	CRJ-200	
C3	Delta Air Lines	Bridge	CRJ-200	
C4	Delta Air Lines	Bridge	CRJ-200	
C6	Delta Air Lines	Bridge	CRJ-200	
C7	Delta Air Lines	Bridge	CRJ-200	
C8	Delta Air Lines	Bridge	CRJ-200	
C9	Delta Air Lines	Bridge	CRJ-200	
C10	Delta Air Lines	Bridge	CRJ-200	
C11	Delta Air Lines	Bridge	CRJ-900	
C12	Delta Air Lines	Bridge	CRJ-200	
C14	Delta Air Lines	Bridge	CRJ-200	
C15	Delta Air Lines	Bridge	CRJ-900	
C16	Delta Air Lines	Bridge	CRJ-200	
C17	Delta Air Lines	Bridge	CRJ-200	
C18	Delta Air Lines	Bridge	CRJ-200	
C19	Delta Air Lines	Bridge	CRJ-900	
C20	Delta Air Lines	Bridge	CRJ-200	
C21	Delta Air Lines	Bridge	CRJ-900	
C22	Delta Air Lines	Bridge	CRJ-200	
C23	Delta Air Lines	Bridge	CRJ-900	
C24	Delta Air Lines	Bridge	CRJ-200	
C25	Delta Air Lines	Bridge	CRJ-900	
C26	Not in-use	Bridge	CRJ-200	
C27	Delta Air Lines	Bridge	CRJ-900	
C28	Not in-use	Bridge	CRJ-200	
C29	Not in-use	Bridge	CRJ-900	
C30	Not in-use	Bridge	CRJ-200	
C31	Not in-use	Bridge	CRJ-900	
C32	Not in-use	Bridge	CRJ-200	
C33	Not in-use	Bridge	CRJ-900	
C34	Not in-use	Bridge	CRJ-200	
C35	Not in-use	Bridge	CRJ-200	
C36	Not in-use	Bridge	CRJ-200	
C37	Not in-use	Bridge	CRJ-200	
C38	Not in-use	Bridge	CRJ-200	
C39	Not in-use	Bridge	CRJ-200	
C40	Not in-use	Bridge	CRJ-900	
C41	Not in-use	Bridge	CRJ-700	
C43	Not in-use	Bridge	CRJ-200	

Table 4-14 *(continued)*
SUMMARY OF PASSENGER GATES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Gate	Airline *(a)*	Gate type	Largest aircraft	Notes
North Terminal				
Concourse D				
D1	United Airlines	Bridge	737-800	
D2	United Airlines	Bridge	737-900	
D3	Common Use	Bridge	767-200	FIS access, D3W accommodates B747-400 ER and restricts D3 and D5B
D4	United Airlines	Bridge	MD-88	
D5A	Common Use	Bridge	757-300WL	FIS access; D5 accommodates A-330-200 and restricts D5A and D5B
D5B	Common Use	Bridge	757-300WL	
D6	United Airlines	Bridge	737-800	
D8	United Airlines	Bridge	757-300	
D9	Common Use	Bridge	757-200	FIS access
D10	Common Use	Bridge	757-200	FIS access
D11	Spirit Airlines	Bridge	757-200	
D12	Spirit Airlines	Bridge	757-200	
D14	Spirit Airlines	Bridge	757-200	
D15	jetBlue Airways	Bridge	757-200	
D16	Frontier Airlines	Bridge	757-200	
D17	Common Use	Bridge	757-200	
D18	American Airlines	Bridge	757-200	
D19	Southwest Airlines	Bridge	737-900WL	
D20	Southwest Airlines	Bridge	737-900WL	
D21	Southwest Airlines	Bridge	737-900WL	
D23	Southwest Airlines	Bridge	737-900WL	
D24	American Airlines	Bridge	A-321-NEO	
D25	American Airlines	Bridge	A-321-NEO	
D26	American Airlines	Bridge	A-321-NEO	
D28	American Airlines	Bridge	757-300	
D30	American Airlines	Bridge	757-300WL	
D32	American Airlines	Bridge	737-800WL	

(a) Includes each airline's regional affiliates.

Source: LeighFisher, based on terminal drawings provided by Wayne County Airport Authority and field verification, January 2016.

Table 4-15
NORTH TERMINAL SPACE ALLOCATION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Space category	Tunnel level	Lower level	Upper level	Total
Airline space *(a)*	80,400	73,200	78,600	232,200
Airport administration	0	24,700	14,700	39,400
Baggage claim	0	35,900	0	35,900
Baggage handling	0	115,200	0	115,200
Concessions	0	14,400	76,000	90,400
Customs and immigration *(b)*	0	64,700	0	64,700
Open/vacant	0	0	7,900	7,900
Other *(c)*	62,200	56,900	37,000	156,100
Public space	0	13,800	127,100	140,900
Security screening *(d)*	0	22,000	18,400	40,400
Total	142,600	420,800	359,500	923,100

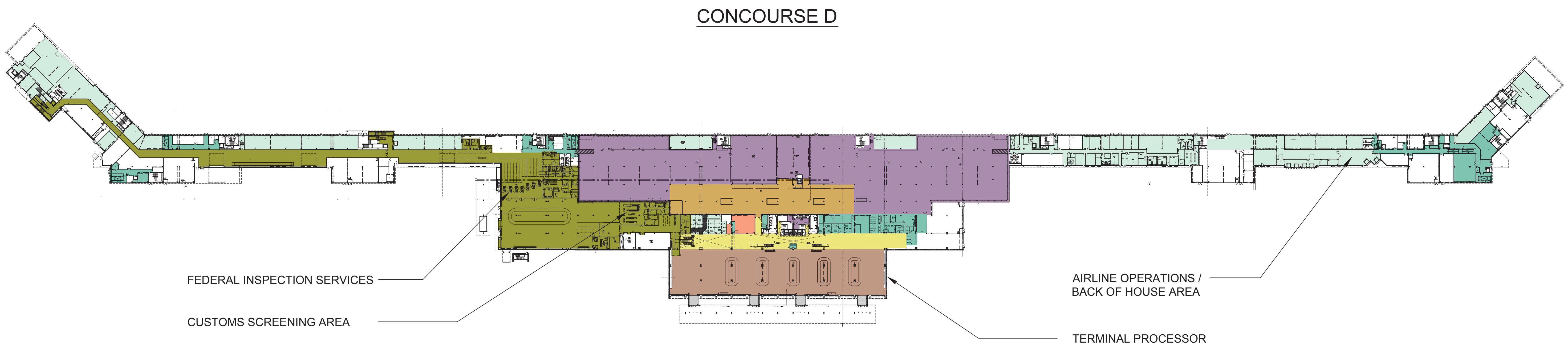
Note: Calculations based on gross areas measured to the outside edge of exterior walls and the center of interior walls, rounded to the nearest hundred square feet.

(a) Includes ticket counters, operations space, departure lounges, and secure office space.
(b) Includes all space allocated for the Federal Inspection Services.
(c) Includes building systems, utilities, and other non-leased spaces within the building.
(d) Includes TSA-leased space within the terminal building.

Source: LeighFisher, based on terminal drawings provided by Wayne County Airport Authority and field verification, February 2016.

The Lower Level contains both the passenger baggage claim and the baggage handling and sorting areas used by airline personnel. Additionally, there are airline office spaces adjacent to the claim areas to support passenger luggage retrieval, Airport police, Authority building maintenance office space, and storage and mechanical spaces.

The Upper Level contains ticket counter check-in positions, airline electronic kiosks for passenger check-in, airline office space, two passenger SSCPs, several concessions spaces in the secure areas of the building, and building mechanical rooms. There is a vertical circulation core at the front of the building that provides access to a bridge over the departures level roadway. This bridge connects to the Ground Transportation Center and parking garage.



S:\DTW\LADTW101\04 Existing Conditions_CAD\Terminal\North Terminal - LF\DTW - NT Exist 02 Arrivals Level - Final Report Version.dwg May 05, 2016 - 10:52pm

LEGEND

- Public circulation
- Baggage claim area
- Airport support
- BSO / Airline support
- Outbound baggage makeup area
- Inbound baggage delivery area
- Customs and Border Protection

NORTH

0 100' 200' 400'

Source: Wayne County Airport Authority

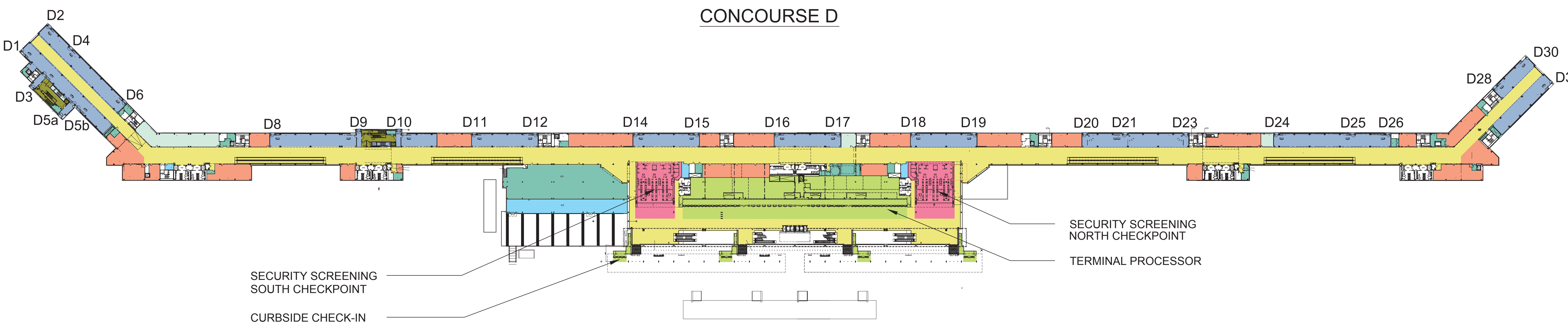
Figure 4-13

OVERALL - LOWER LEVEL
NORTH TERMINAL

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

Leigh|Fisher



LEGEND

- Public circulation
- Concessions
- Security screening checkpoint
- Ticketing / Airline ticket office
- Customs and Border Protection
- Airport support
- BSO / Airline support
- Miscellaneous / Others

NORTH

0 100' 200' 400'

Source: Wayne County Airport Authority

Figure 4-14
OVERALL - UPPER LEVEL
NORTH TERMINAL
Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

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4.3.2.1.1 Baggage

Baggage claim facilities are located on the Lower Level of the terminal processor. There are five common-use carousel claim devices for domestic flights and one carousel claim device for international flights (located within the FIS facility). Spirit Airlines, American Airlines, and Southwest Airlines each occupy one carousel claim. United Airlines, Air Canada, and Alaska Airlines share a single carousel that is also used by Spirit Airlines during off-peak times. The remaining domestic carousel is allocated based on airline demand and is used primarily during peak times. There is one central oversized baggage claim. All airlines maintain baggage service offices to handle passenger baggage inquiries. Inbound and outbound baggage make-up facilities, in which airline personnel transfer baggage to and from conveyor belt systems onto carts to be transported directly to aircraft, are located on the Lower Level, to the west of the claim devices. Baggage originating at the ticketing facilities on the Upper Level is transported downstairs to the baggage screening facility, then onto baggage makeup carousels or laterals.

4.3.2.1.2 Ticketing

There is a ticketing lobby on the terminal processor's Upper Level that provides positions for airline agents and electronic kiosks to support the checking-in of airline passengers and baggage. In total, there are 86 positions allocated to individual airlines on an exclusive-use basis, with the exception of seven positions allocated as common-use for international carriers. The location and number of positions occupied by each airline is summarized in Table 4-16. TSA screening of checked baggage is located on the Lower Level.

4.3.2.1.3 Passenger Security Screening Checkpoints

There are two passenger SSCPs, one on each side of the ticketing lobby, that provide metal detector and x-ray screening of passenger and baggage to facilitate access to the secure concourse areas. In total, there are 10 checkpoint lanes: five on the north side and five on the south side.

Table 4-16
NORTH TERMINAL AIRLINE TICKETING POSITIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Airline	Agent positions	Kiosk positions *(a)*	Total
Air Canada	5	0	5
Alaska Airlines	8	0	8
American Airlines	14	11	25
Common-use International	7	0	7
Frontier Airlines	4	0	4
jetBlue Airways	4	3	7
Lufthansa	6	0	6
Southwest Airlines	10	0	10
Spirit Airlines	16	8	24
United Airlines	12	2	14

(a) An additional six kiosks are provided in the ticket lobby and serve as common-use for multiple airlines.

Source: LeighFisher field verification, February 2016.

4.3.2.1.4 Federal Inspection Services Facility

Four gates at the southern end of Concourse D are tied to sterile corridors that connect the passenger loading bridges to the Airport's FIS screening facility. They occupy approximately 65,000 square feet on the Lower Level beneath the concourse. The FIS provides immigration processing for passengers arriving from abroad, baggage claim devices, customs screening of baggage, and office space for the U.S. Customs and Border Protection. Once arriving passengers and their bags have been processed, they are directed into the domestic baggage claim lobby.

4.3.2.2 Passenger Concourse

Concourse D provides 27 gates available for active loading and unloading of passengers, baggage, and belly cargo. The concourse is linear in a north-south orientation to the terminal processor. The portions of Concourse D adjacent to the terminal processor are single-loaded (i.e., containing passenger gates on only one side), while areas at the end to the south are double-loaded.

Most of concourse D has two levels: a Lower Level used by airline tenants as operation space; and an Upper Level containing passenger gates, departure lounges, concessions, restrooms, and a Lufthansa Senator Lounge. The Lower and Upper Levels of Concourse D are depicted on Figures 3-21 through 3-26. In total, the concourse provides approximately 509,200 square feet of usable space.

Six airlines possess preferential lease agreements for gate use on Concourse D. The Authority controls the remaining five gates (D3, D5A/D5B, D9, D10, and D17). A summary of airline gate assignments and aircraft parking capabilities is provided in Table 4-14.

4.3.3 Aircraft Parking Apron

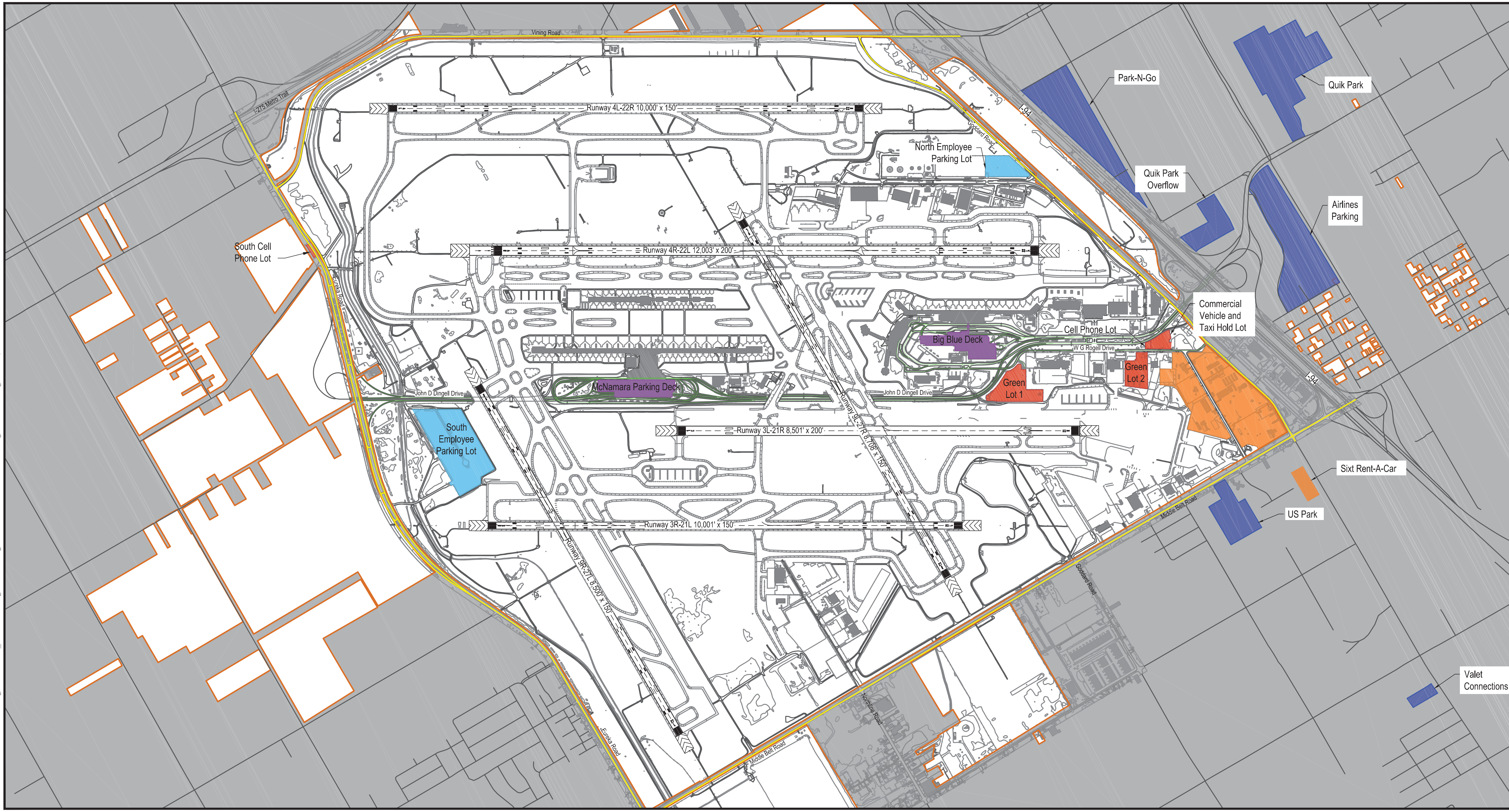
Approximately 139 acres of apron are available for aircraft maneuvering and parking at the passenger terminal. The apron is currently configured to accommodate aircraft ranging from small regional jet aircraft (CRJ-200 and ERJ-145) to large widebody aircraft (B747-400). Currently, there are 147 aircraft parking positions that provide direct access to the terminal. All parking positions are equipped with passenger loading bridges. Some of the gates on the west side of Concourse A are equipped with dual loading bridges to accommodate larger aircraft. The largest aircraft that can be accommodated at each parking position is identified in Table 4-14.

As shown on Figure 4-4, gates on the north east side of Concourse A are accessed from Taxiway U via dual Taxilanes U-7 and U-8. Gates on the south east side of Concourse A are accessed from Taxiway J via dual Taxilanes J-7 and J-8. Two taxilanes, Q and U-9, provide access to the gates on the west side of Concourse A and the east side of Concourses B and C. Gates on the west side of Concourses B and C are accessed directly from Taxiway K. Aircraft accessing Concourse D utilize Taxilanes E, E-2, and E-3. Taxilane E runs parallel to Taxiway K.

A system of service roadways located around the concourses allows for the safe and efficient movement of ground support equipment and other motorized vehicles on the aircraft apron. These roadways are striped on the apron. There are several locations beneath each of the four concourses where low-clearance ground support equipment can pass, avoiding a potentially lengthy drive around the ends of the concourses.

4.4 GROUND TRANSPORTATION AND PARKING

This section summarizes the Airport's ground access and parking facilities, and the current levels of activity occurring at those facilities. Figure 4-15 depicts key ground access and parking facilities referenced throughout.



S:\DTW\LADTW101\04 Existing Conditions_CAD\C&S\Figure 4.3-1\Fig 4-1 Ground Access and Parking Facilities.dwg Mar 17, 2016 - 11:06am

LEGEND

- Airport Property Line
- Airport perimeter roadways
- Primary access and terminal circulation
- Employee Surface Parking
- Off-airport parking facilities
- Public parking - surface
- Public parking - structure
- Rental car facilities

NORTH

0 1000' 2000' 4000'

Figure 4-15
GROUND TRANSPORTATION ACCESS AND PARKING FACILITIES
Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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4.4.1 Data Sources and Assumptions

Previously prepared reports, available traffic data, and surveys of on-Airport traffic were reviewed and conducted to assess existing levels of activity on ground transportation and parking facilities. The following identifies the traffic surveys conducted as part of this Master Plan Update.

- **Vehicle Dwell Time Survey** – Surveyors used a predetermined randomization methodology to track the time vehicles are stopped at the curbside or in the second lane. The randomization methodology consisted of monitoring several cars at once and watching the fourth or fifth vehicle that enters the curbside after a previously monitored car has exited. Surveying occurred during a three-hour AM peak period and a three-hour PM peak period* for two days at each terminal during the week of January 25, 2016. Data were collected at the following curbside locations: North Terminal Departures and Arrivals Level, North Terminal GTC, McNamara Terminal Departures and Arrivals Level, McNamara Terminal International Level, and McNamara Terminal GTC.

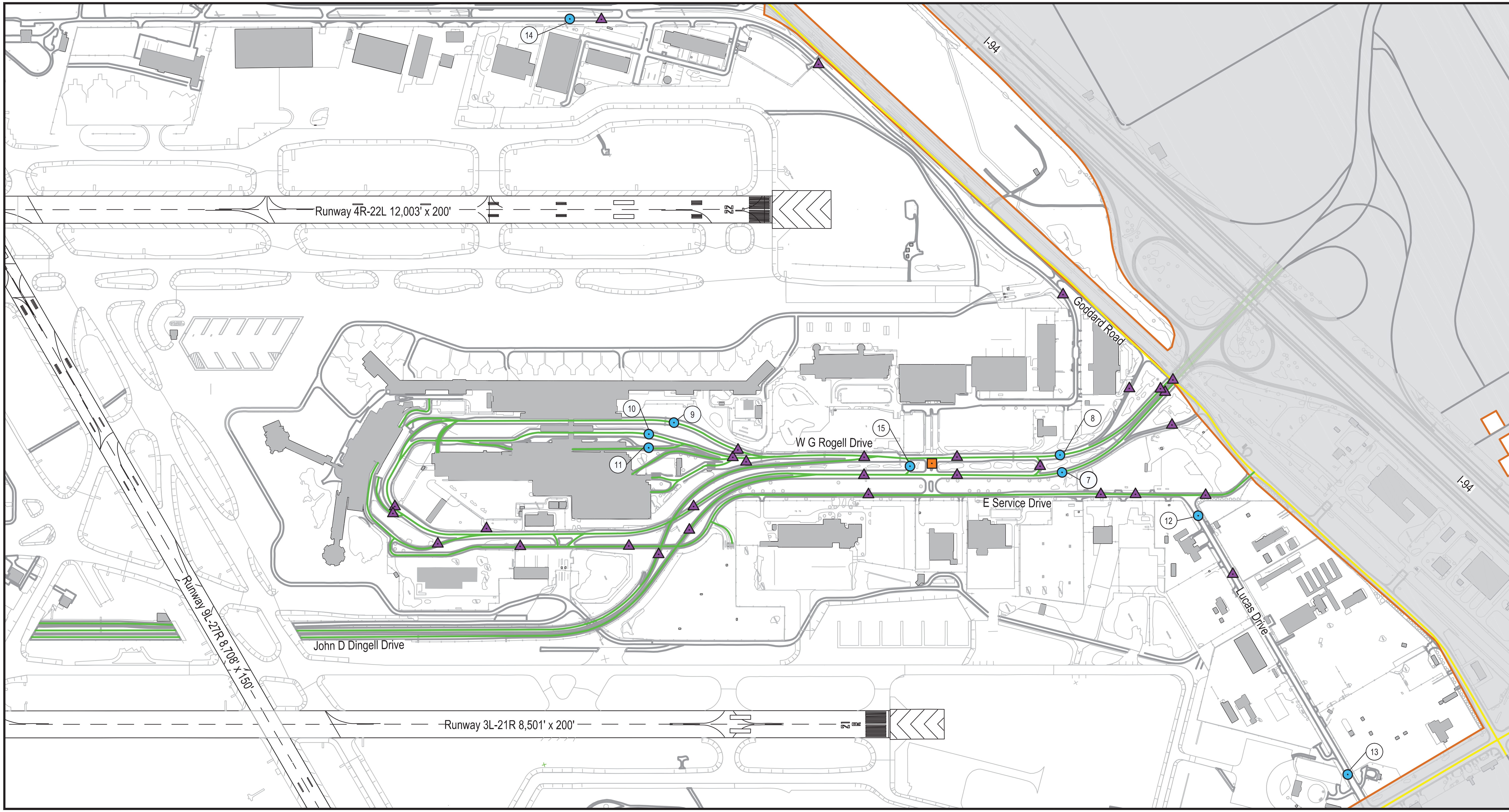
- **Commercial Vehicle Split/Classification Survey** – Surveyors located along the entry-road of the GTCs counted the volume of entering vehicles and recorded the type of vehicle, including: taxi, limos, shared-ride shuttles, hotel shuttles, off-Airport parking shuttles, transit bus, green lot bus, rental car shuttle/bus, private autos, and others (police, delivery, etc.). Surveying occurred during a three-hour AM peak period and a three-hour PM peak period.

- **GTC Entry Surveys** – North Terminal (January 25 and 26, 2016); McNamara Terminal (January 27 and 28, 2016).

- **Traffic and Turning Movement Counts** – Traffic counts were conducted during the week of January 25, 2016 at locations depicted on Figures 4-16 and 4-17. Traffic counts completed in 2011 for 24-hour periods at 56 locations are also shown on Figures 4-16 and 4-17 - see Appendix D. Turning movement counts were conducted at the intersection of W. G. Rogell Drive and Service Drive for a three-hour AM peak period and a three-hour PM peak period on January 27, 2016.

Several ground transportation improvements are planned in the near term. The improvements to the W. G. Rogell-Burton intersection, as shown on Figure 4-18 include the addition of two U-turns, one north of the intersection and one to the south. The improvements will result in the removal of the existing U-turn just south of the intersection. This project is being completed to alleviate queueing and improve traffic flow. It is anticipated that the former Yellow Lot will be reopened for employee parking.

*The two peak periods at the Airport are 5:30 a.m. to 9:30 a.m. and 6:00 p.m. to 9:00 p.m.



F:\Project\899 - WCAA\899019001 - DTW Airport Master Plan\Planning-Study\CADD\Sheet Files\X.X-X Traffic Volume Count Locations - North.dwg Feb 29, 2016

LEGEND

- Airport Property Line
- Airport perimeter roadways
- Primary access and terminal circulation
- Daily traffic count locations (2011)
- Week long traffic count locations (2016)
- Traffic turning movement count locations (2016)

NORTH

0 350' 700' 1400'

Figure 4-16
TRAFFIC VOLUME
COUNT LOCATIONS - NORTH

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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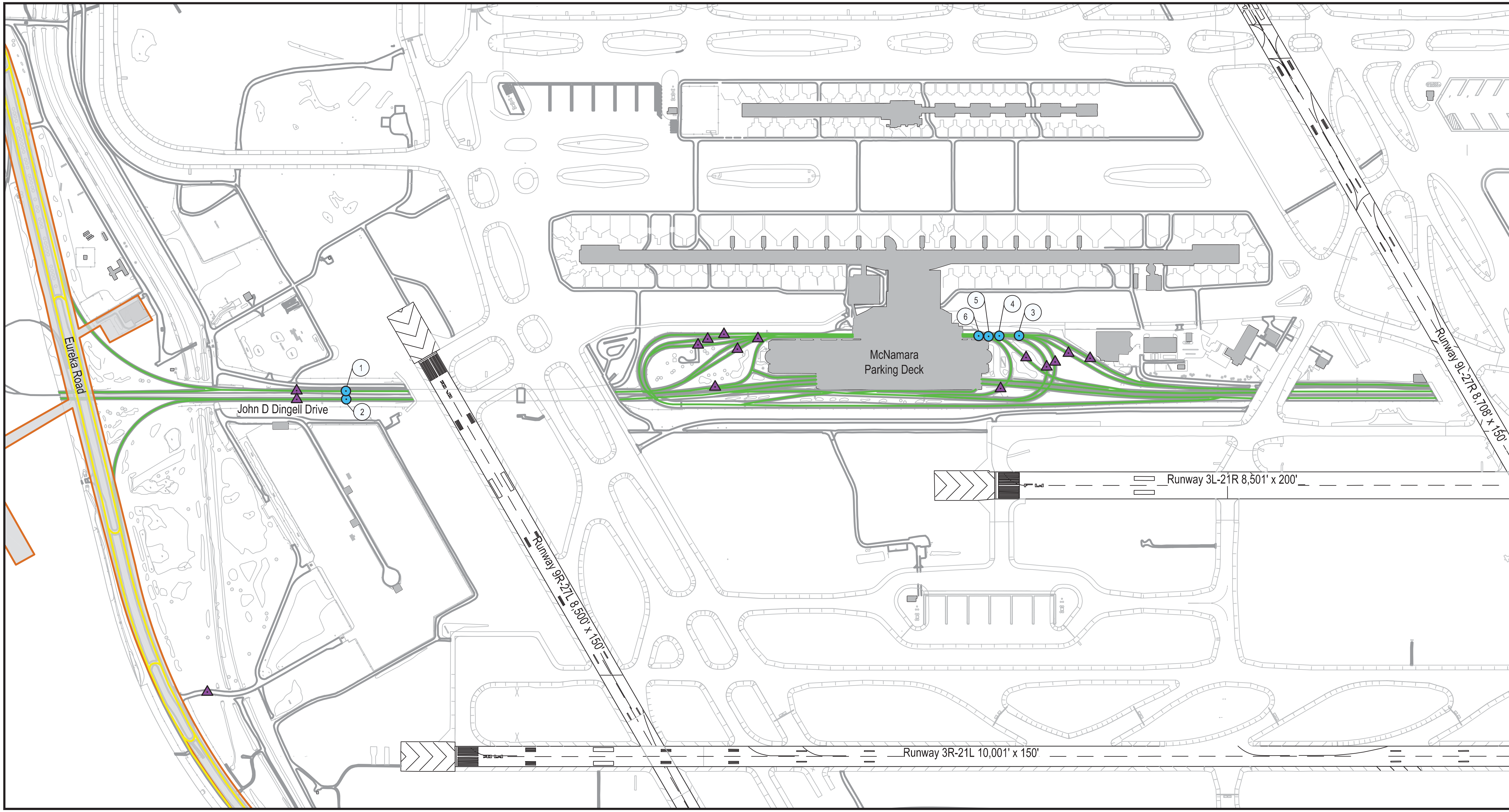

LEGEND

- Airport Property Line
- Airport perimeter roadways
- Primary access and terminal circulation
- Daily traffic count locations (2011)
- Week long traffic count locations (2016)
- Traffic turning movement count locations (2016)

NORTH

0 350' 700' 1400'

Figure 4-17
TRAFFIC VOLUME
COUNT LOCATIONS - SOUTH

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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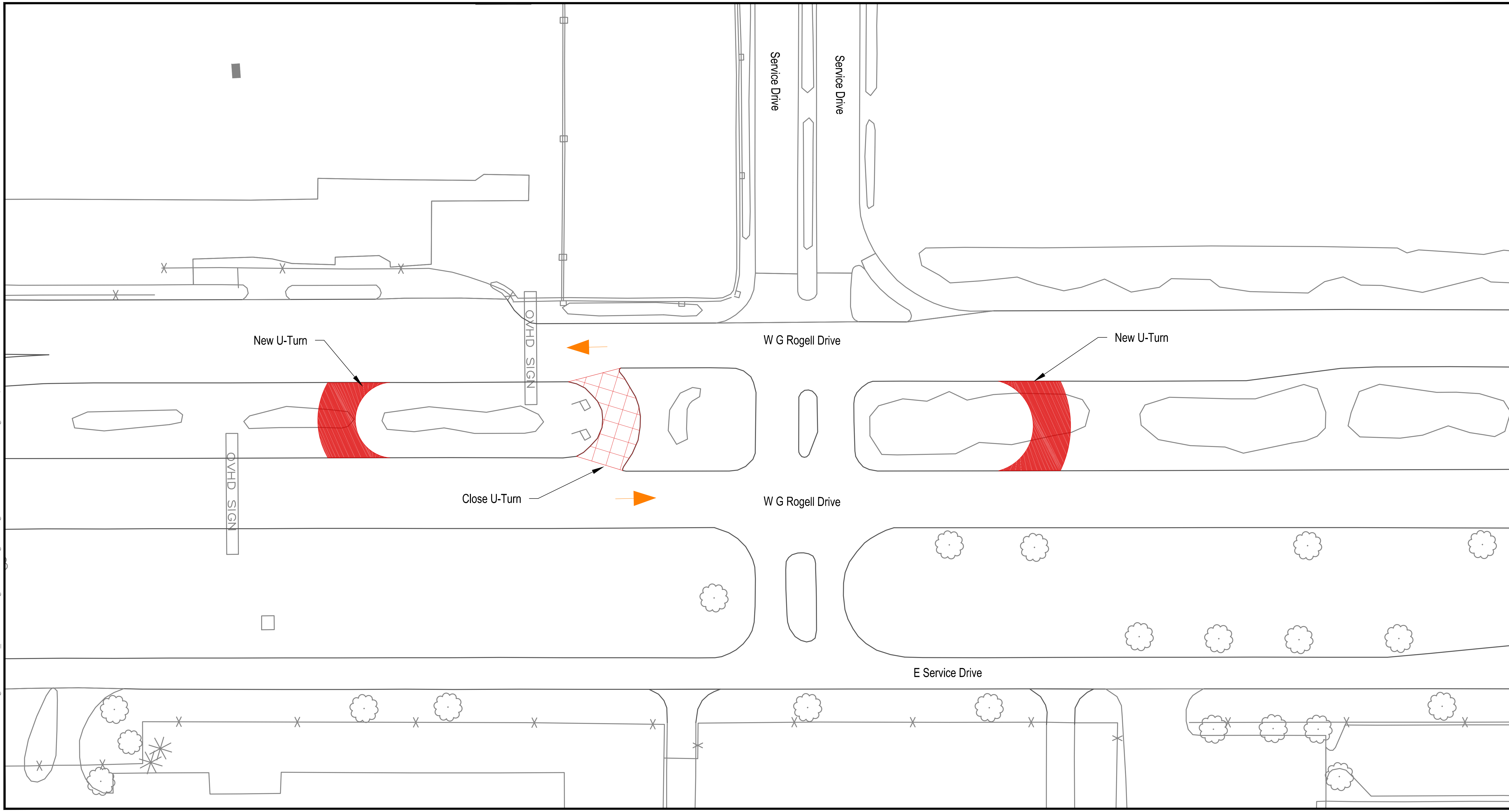

LEGEND

Proposed pavement

Proposed pavement removal

Direction of flow

Figure 4-18
ROGELL/BURTON INTERSECTION IMPROVEMENTS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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4.4.2 Regional Transportation Plans

The Southeast Michigan Council of Governments (SEMCOG) developed a Regional Transportation Plan in 2004, which will invest more than $40 billion in preserving, enhancing, and operating Southeast Michigan's roadways, bridges, airports, non-motorized pathways, transit vehicles, and facilities by 2030. One regional initiative of this long-range plan is to provide rail service in the Ann Arbor-Detroit corridor by upgrading existing infrastructure to provide commuter rail service with stops in Ann Arbor, Ypsilanti, Detroit Metropolitan Airport, Dearborn, and Detroit. An Alternatives Analysis/Environmental Impact Statement is also being conducted to determine the most sustainable practices for this project.

Various infrastructure improvement such as traffic signal modernization, road reconstruction and rehabilitation, bridge improvements, lane expansions, and safety improvements have also been identified for various roads and streets in Wayne County. The closest specified transportation project to the Airport, based on the 2004 Project List, is on the eastern Airport property line where Middle Belt Road will be widened from two to five lanes from Eureka Road to North Line Road. Other locations in the Airport vicinity where lane widening to five lanes is occurring include: Ecorse Road, from Merriman to Inkster (approximately one mile north of the Airport); Sibley Road, from Telegraph to Toledo (approximately two miles south of the Airport); and Belleville Road, from Tyler to Ecorse (approximately six miles west of the Airport).

4.4.3 Airport Perimeter Roadways and Intersections

The Airport is bound by I-94 to the north, I-275 to the west, Middle Belt Road to the east, and Eureka Road to the south. Access to the North and McNamara terminals is as follows and highlighted on Figure 4-15:

- Merriman Road provides the principal access route to the north end of the Airport from I-94 and points north before turning into W. G. Rogell Drive approaching the North Terminal complex.
- From the south, the Airport is accessed from I-275 via Eureka Road to John D. Dingell Drive. John D. Dingell Drive provides access to the McNamara Terminal from the south and continues northward to connect to the North Terminal.
- Locally, the Airport can be accessed from the east via Middle Belt Road and from the west via Vining Road, both of which connect to I-94 Service Drive/Goddard Road Extension and W. G. Rogell Drive at the north end of the Airport and Eureka Road and John D. Dingell Drive at the south end. The western perimeter of the Airport is bordered by Wayne Road from the south before becoming Vining Road. Wayne Road can be accessed from the south at the intersection of Eureka Road and Wahrman Street, which runs parallel to I-275.

Table 4-17 summarizes peak AM and PM traffic volumes for off-Airport and perimeter roadways.

Table 4-17
OFF-AIRPORT PEAK HOUR TRAFFIC VOLUMES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

			AM		PM	
Route	Direction	Location	Peak	Volume	Peak	Volume
Wahrman Rd.	South	Between Northline Rd. and Eureka Rd.	8:00	166	17:00	289
Wahrman Rd.	North	Between Northline Rd. and Eureka Rd.	8:00	297	15:00	201
Wayne Rd.	South	0.3 Miles of Goddard Rd.	8:00	120	16:00	167
Wayne Rd.	North	0.3 Miles of Goddard Rd.	9:00	169	16:00	165
Merriman Rd.	South	At I-94 Overpass	12:00	1,305	13:00	1,701
Merriman Rd.	North	At I-94 Overpass	11:00	1,119	15:00	1,799
Middle Belt Rd.	South	Between Northline Rd. and Eureka Rd.	N/A	N/A	18:00	623
Middle Belt Rd.	North	Between Northline Rd. and Eureka Rd.	8:00	664	16:00	457
I-275	South	0.5 Miles North of Eureka Rd. Interchange	8:00	2,922	17:00	3,627
I-275	North	0.5 Miles North of Eureka Rd. Interchange	8:00	3,898	18:00	2,875

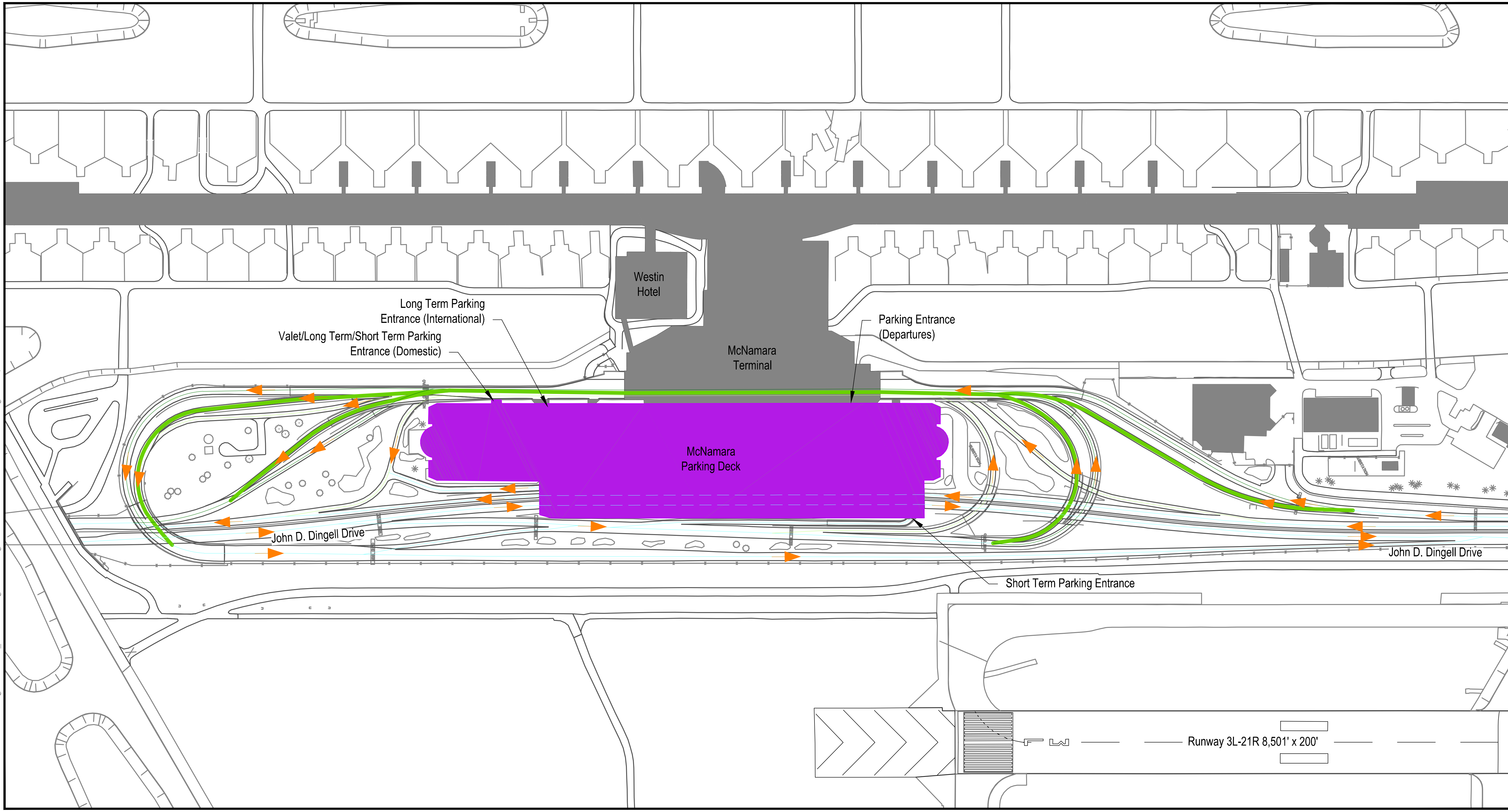
Note: Data collected for Wahrman Road on 12/14/15, Wayne Road on 12/14/15, Merriman Road on 12/15/15, Middle Belt Road on 12/8/15, and I-275 on 11/2/15.

Source: Michigan Department of Transportation, Planning-Traffic Monitoring Information System (TMIS) database.

4.4.4 Passenger Terminal Circulation Roadways

Both passenger terminals are served by one-way, counterclockwise loop roads that separate departure and arrival traffic, parking and ground transportation services, and commercial vehicles.

At the North Terminal, the loop splits into three roadways. These three roadways serve the departures curbside, arrivals curbside, and GTC. The roadways also provide entrances for short- and long-term parking at the Big Blue Deck. The exit loop for the North Terminal runs to the North where access ramps to I-94 are located. To continue south, drivers must use a U-turn at Service Drive in order to proceed south on John D. Dingell Drive to the McNamara Terminal and points south. Figure 4-19 shows the circulation roadways associated with the McNamara Terminal and Figure 4-20 shows the circulation roadways associated with the North Terminal.



LEGEND

- McNamara Terminal circulation roadways - Upper level (Departures)
- Terminal circulation roadways - Middle level (Domestic Arrivals)
- Terminal circulation roadways - Lower level (International Arrivals)
- Other terminal roadways
- Public parking - structure
- Direction of travel

NORTH

0 150' 300' 600'

Figure 4-19
McNAMARA TERMINAL CIRCULATION ROADWAYS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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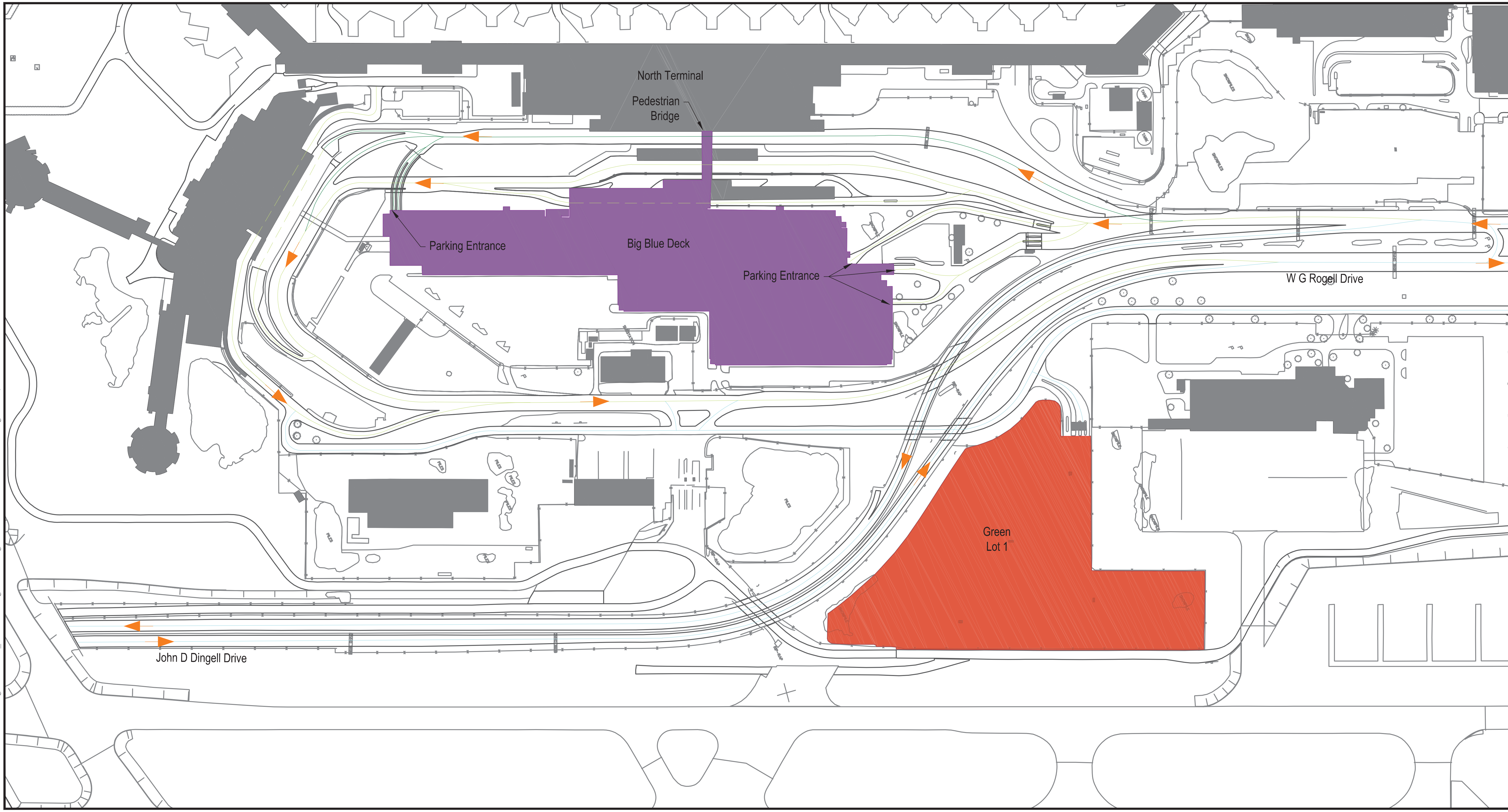

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LEGEND

- North terminal circulation roadways - Upper level (Departures)
- North terminal circulation roadways - Lower level (Arrivals)
- Other terminal roadways
- Public parking - surface
- Public parking - structure
- Employee parking
- Direction of travel

NORTH

0 150' 300' 600'

Figure 4-20
NORTH TERMINAL CIRCULATION ROADWAYS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

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The McNamara Terminal loop road splits into four roadways that serve the departures curbside, arrivals curbside, international arrivals curbside, and GTC. The loop also provides separate access to short-term parking, valet services, and long-term parking. As with the North Terminal, once past McNamara, drivers have the option of continuing on John D. Dingell Drive to Eureka Road, traveling northbound to the North Terminal or other points north, or returning to the McNamara Terminal.

Table 4-18, in combination with Figures 4-16 and 4-17, presents hourly traffic volumes on Airport non-terminal roadways during peak periods. Table 4-19 shows the peak hour turning movement counts for the intersection of W. G. Rogell Drive and Service Drive. Table 4-20 shows the vehicle split at this intersection.

A larger vehicle volume was observed on non-terminal and circulation roadways in the evening than in the morning. The morning peak volume was observed at 1,820 vehicles on W. G. Rogell Drive southbound at 5:45 a.m. on a Monday. The lowest morning peak volume was observed on West Service Road southbound at 52 vehicles at 5:15 a.m. on a Thursday. The largest evening peak occurred on W. G. Rogell Drive northbound at 2:30 p.m. on a Friday at a volume of 1,768 vehicles. The smallest evening peak observed occurred on West Service Road northbound at 10:00 p.m. on a Wednesday at a volume of 41 vehicles.

Turning movement counts were recorded at the intersection of W. G. Rogell Drive and Burton Drive. During this six-hour survey, three vehicles were observed making an illegal left turn from W. G. Rogell Drive northbound onto Burton Drive westbound. The majority of vehicles observed at the intersection went straight through, continuing onto W. G. Rogell Drive northbound or southbound. A vehicle split of this intersection indicates that the majority of vehicles observed were passenger cars, followed by buses, single units, and then heavy trucks.

Table 4-21 and Table 4-22, in combination with Figures 4-16 and 4-17, summarize peak hour traffic volume at the McNamara Terminal and the North Terminal.

At the McNamara Terminal, morning hour traffic peaked at 772 vehicles at 6:15 a.m. on a Monday and evening hour traffic peaked at 555 vehicles at 1:30 p.m. on a Sunday. The largest morning peak in traffic observed at the North Terminal occurred at 5:15 a.m. on a Monday at 461 vehicles and the largest evening peak in traffic occurred at 2:00 p.m. on a Saturday at 440 vehicles.

Table 4-18
NON-TERMINAL PEAK HOUR TRAFFIC VOLUMES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

		AM Peak			PM Peak		
Count	Description	Peak hour	Day	Volume	Peak hour	Day	Volume
1 NB	John D. Dingell Dr. (between tunnel & Eureka Rd.)	6:30 a.m.	Monday	657	1:30 p.m.	Sunday	514
2 SB	John D. Dingell Dr. (between tunnel & Eureka Rd.)	11:00 a.m.	Friday	407	2:15 p.m. & 2:30 p.m.	Friday	707
7 SB	W. G. Rogell Dr. (1,000' North of Burton Dr.)	5:45 a.m.	Monday	1,820	1:30 p.m.	Thursday	1,686
8 NB	W. G. Rogell Dr. (1,150' North of Burton Dr.)	10:45 a.m.	Monday	1,115	2:30 p.m.	Friday	1,768
12 EB	Lucas Dr. (Southwest End- 150' East of E. Service Dr.)	11:00 a.m.	Friday	293	3:15 p.m.	Thursday	410
12 WB	Lucas Dr. (Southwest End- 200' East of E. Service Dr.)	9:00 a.m.	Tuesday	190	6:00 a.m.	Monday	208
13 EB	Lucas Dr. (Northeast End- 350' West of Middle Belt Rd.)	9:30 a.m.	Monday	491	3:00 p.m.	Monday	480
13 WB	Lucas Dr. (Northeast End- 400' West of Middle Belt Rd.)	11:00 a.m.	Friday	269	1:00 p.m.	Friday	377
14 NB	W. Service Rd. (100' South of Central Maintenance Dr.)	6:30 a.m.	Thursday	97	10:00 p.m.	Wednesday	42
14 SB	W. Service Rd. (350' South of Central Maintenance Dr.)	5:15 a.m.	Thursday	52	8:00 p.m. & 8:15 p.m.	Tuesday	44
15 NB	W. G. Rogell Dr. NB-SB Crossover (250' South of Burton Dr.)	11:45 p.m.	Saturday	461	1:15 p.m.	Thursday	465

Source: Traffic Data Collection, data collected January 22 to 30, 2016.

Table 4-19
PEAK HOUR TRAFFIC VOLUMES – INTERSECTION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Direction	5:30 a.m. – 8:30 a.m.	6:00 p.m. – 9:00 p.m.
W. G. Rogell Drive Southbound		
Right	153	49
Thru	3,262	2,273
Left	252	186
Burton Drive Westbound		
Right	49	140
Thru	94	148
Left	104	169
W. G. Rogell Drive Northbound		
Right	164	137
Thru	2,124	2,937
Left	2	1
Burton Drive Eastbound		
Right	38	66
Thru	63	63
Left	115	95

Notes: The intersection of W. G. Rogell Drive and Burton Drive is signalized. Northbound Left Turns are prohibited.

Source: Traffic Data Collection, data collected January 27, 2016.

Table 4-20

PEAK HOUR VEHICLE SPLIT – INTERSECTION (Percent Total Volume)

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

	Passenger Cars		Buses		Single Units		Heavy Trucks	
Direction	AM	PM	AM	PM	AM	PM	AM	PM
W. G. Rogell Drive Southbound								
Right	94.4	92.9	1.9	7.1	1.9	0	1.9	0
Thru	87.4	81.4	12	18.4	0.2	0.2	0.3	0
Left	98	95.7	2	2.1	0	1.1	0	1.1
Burton Drive Westbound								
Right	95.2	100	0	0	0	0	4.8	0
Thru	95.0	97.8	5.0	0	0	2.2	0	0
Left	100.0	97.7	0	0	0	2.3	0	0
W. G. Rogell Drive Northbound								
Right	97.6	100	0	0	2.4	0	0	0
Thru	83.8	82.2	15.4	17.7	0.5	0.1	0.2	0
Left	0	0	0	0	0	0	0	0
Burton Drive Eastbound								
Right	100	100	0	0	0	0	0	0
Thru	75	100	10	0	15	0	0	0
Left	95.5	97.9	0	2.1	4.5	0	0	0
Total Combined	87.3	84.6	11.9	15.1	0.5	0.3	0.3	0

Notes: The intersection of W. G. Rogell Drive and Burton Drive is signalized without pedestrian signals. Northbound left turns are prohibited.

Source: Traffic Data Collection, data collected January 27, 2016 (5:30 to 8:30 a.m. and 6:00 to 9:00 p.m.).

Table 4-21
McNAMARA TERMINAL PEAK HOUR TRAFFIC VOLUMES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

		AM Peak			PM Peak		
Count	Description	Peak hour	Day	Volume	Peak hour	Day	Volume
3 SB	Departures (Upper Level)	6:15 a.m.	Monday	772	1:30 p.m.	Sunday	555
4 SB	Arrivals (Middle Level)	11:00 a.m.	Saturday	397	8:45 p.m.	Sunday	524
5 SB	Ground Transportation Center	11:00 a.m.	Monday	225	4:15 p.m.	Monday	277
6 SB	International Arrivals (Lower Level)	6:15 a.m.	Monday	624	1:30 p.m.	Monday	358

Source: Traffic Data Collection, data collected January 22 to 30, 2016.

Table 4-22
NORTH TERMINAL PEAK HOUR TRAFFIC VOLUMES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

		AM Peak			PM Peak		
Count	Description	Peak hour	Day	Volume	Peak hour	Day	Volume
9 SB	Departures (Upper Level)	5:15 a.m.	Monday	461	1:30 p.m.	Friday	416
10 SB	Arrivals (Lower Level)	12:30 a.m.	Saturday	394	11:30 p.m.	Sunday	536
11 SB	Ground Transportation Center	10:15 a.m.	Tuesday	184	4:00 p.m.	Monday	204

Source: Traffic Data Collection, data collected January 22 to 30, 2016.

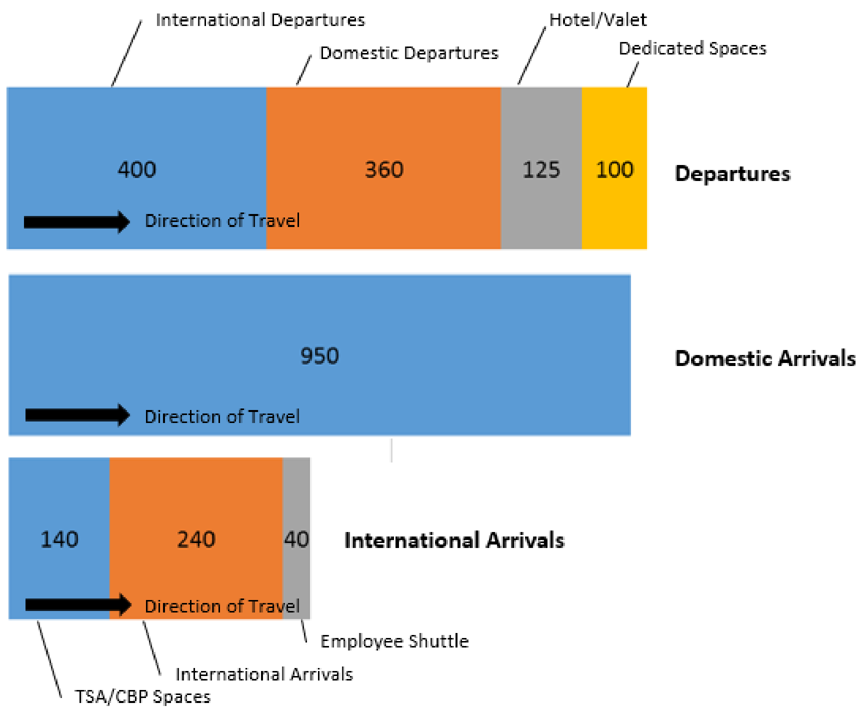
4.4.5 Terminal Curbside Facilities

The following describes the layout and use of the curbsides at the North and McNamara Terminals.

4.4.5.1 McNamara Terminal

Figure 4-21 conceptually depicts the curb frontage and allocation of curb frontage among functions for the McNamara Terminal. The upper level roadway is dedicated to departures. Short-term and valet parking in the garage are also accessed from this roadway. The departures curb frontage is approximately 985 linear feet long. There is a dedicated lane at the far left to access parking, two through lanes, and two loading/unloading lanes. There are no pedestrian at-grade crossings on this or any other level of the McNamara Terminal.

Figure 4-21
McNAMARA TERMINAL CURB FRONTAGE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: Image not to scale.

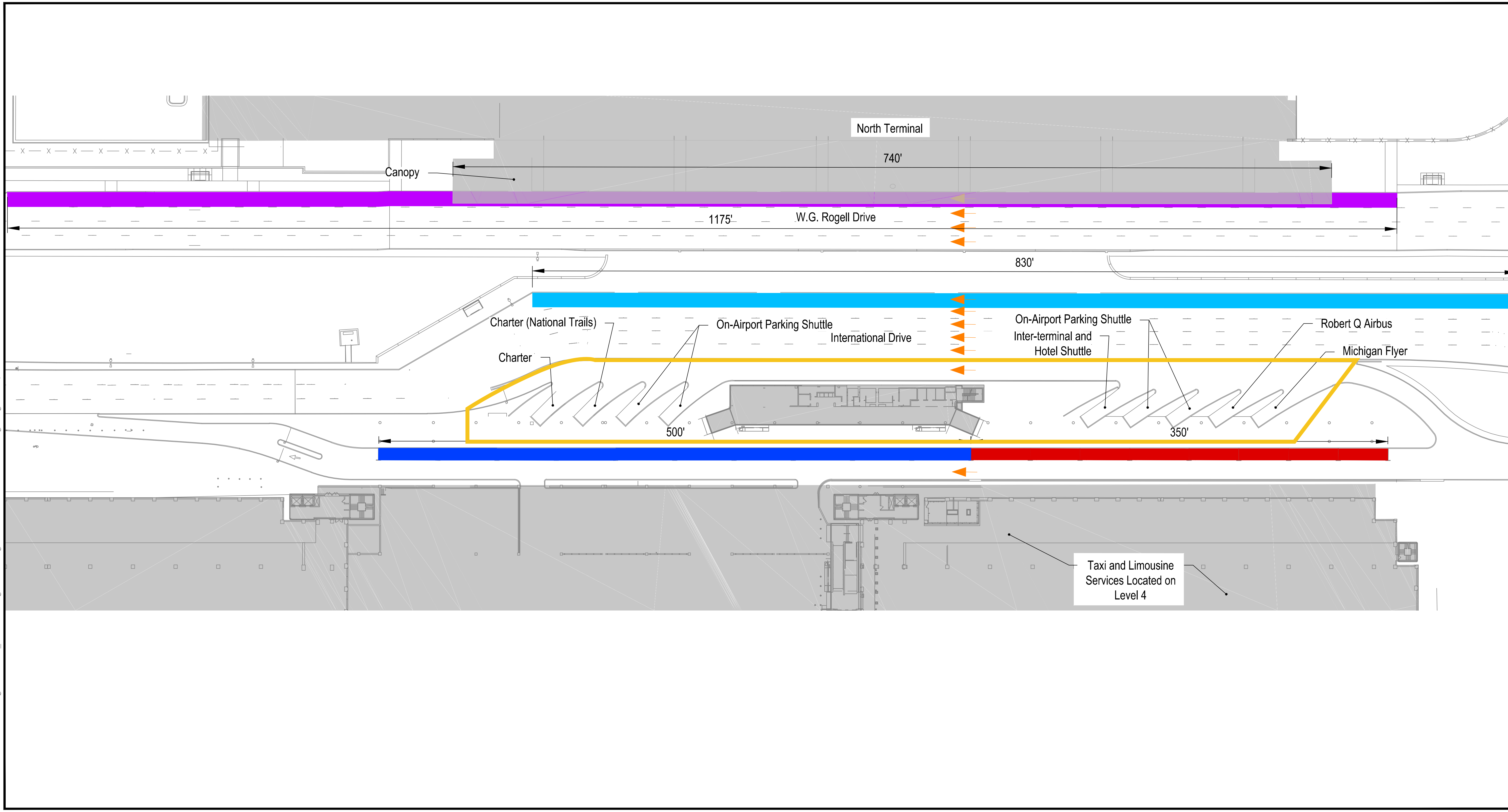
Source: C&S Engineers, Inc., February 2016.

The domestic arrivals or middle roadway level accommodates domestic arrivals as well as the GTC in the McNamara Parking Garage. There are three loading/unloading lanes and two through lanes.

The lower level at the McNamara Terminal is dedicated to international arrivals with Delta DASH Cargo and loading docks at the south end of the frontage area. There are three loading/unloading lanes and two through lanes along 420 linear feet of curbside. Access to the parking garage is provided to the left past the frontage area.

4.4.5.2 North Terminal

Figure 4-22 shows the curb frontage roadways for the North Terminal. Drivers dropping off passengers at the North Terminal use the upper level roadway. There is approximately 1,120 linear feet of curb frontage. This roadway consists of four lanes – a loading/unloading lane, two through lanes, and a lane that exits left for parking in the Big Blue Deck. Pedestrians from the Big Blue Deck or other ground transportation services are directed to use an above-ground pedestrian bridge; therefore, there are no at-grade pedestrian crossings at this level.



LEGEND

Direction of flow

Arrivals

Departures

Off airport parking and hotel shuttles

Rental car shuttles

Ground Transportation Center

NORTH

0 40' 80' 160'

Figure 4-22

NORTH TERMINAL CURB FRONTAGE AND GROUND TRANSPORTATION CENTER

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

LeighFisher

The lower level at the North Terminal consists of five lanes – two marked loading/unloading lanes, and three through lanes. The curb frontage length is approximately 820 linear feet. Commercial vehicles and those looking for the Big Blue Deck are directed to their designated areas before approaching the curb frontage area. As with the upper roadway, there are no at-grade pedestrian crossings.

4.4.5.3 Vehicle Classifications

The vehicular fleet mix at each terminal was sorted into the vehicle classes of taxicab, limousine, shared-ride shuttle, hotel/motel shuttle, off-Airport parking shuttle, public transit bus, green lot bus, rental car bus, private vehicle, and other. The vehicular fleet mix on the different roadways at each terminal is summarized in Tables 4-23 and 4-24.

At the North Terminal, it was observed that the Departures Level was dominated by passengers unloading from private vehicles in the morning. Approximately 96% of the vehicles observed during the morning peak period were private vehicles and 99% were private vehicles in the evening peak period. Observations at the Arrivals Level were similar, with private vehicles occupying a majority of the curbside. Unlike the Departures Level, the Arrivals Level experienced a larger volume of private vehicle during the evening peak period representing 97% of the total observed volume, versus 93% of the total traffic during the morning peak period. On the Arrivals Level during the evening peak period, Airport police made a consistent effort to keep traffic moving and to ensure only vehicles that were actively unloading or loading remained parked at the curbside.

At the McNamara Terminal, the Departures Level was primarily used by private vehicles (91% in both AM and PM peak), followed by taxicabs (7% in both AM and PM peak). The Departures level also had a higher vehicular traffic volume in the morning than in the evening. The Arrivals Level was equally dominated by private vehicles during the morning and evening peak periods. The International Level was split approximately even between private and other vehicles in the morning. In the evening, there was a split of approximately 73% private vehicles and 27% other vehicles.

4.4.5.4 Curbside Dwell Times

Tables 4-23 and 4-24 also summarize the results of curbside dwell time surveys conducted during peak periods on the different roadways at each terminal.

At the McNamara Terminal, the longest observed dwell time at the Departures Level was approximately six and a half minutes for vehicles such as police and delivery cars during the morning peak period. The shortest dwell times for both the morning and evening peak periods were observed for public transit buses at 28 and 39 seconds respectively. On the Arrivals Level, dwell times for vehicles such as police and delivery cars were also observed to be the longest at almost 9 minutes in the morning and 17 minutes in the evening. Private vehicles also displayed a significantly longer dwell time on the Arrivals Level than the Departures Level, with an average dwell time of six minutes and one seconds. The longest average dwell time observed on the International Level was almost eight minutes by private vehicles in the evening.

Table 4-23
PEAK PERIOD VEHICLE FLEET MIX AND AVERAGE DWELL TIME – McNAMARA TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Departures (Upper Level)				Arrivals (Middle Level)				International (Lower Level)				GTC			
	AM		PM		AM		PM		AM		PM		AM		PM	
Vehicle class	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent
Taxicab	0:01:57	7.4%	0:01:45	7.1%	0:02:26	0.9%	--	--	--	--	--	--	N/A	8.1%	N/A	23.4%
Limousine	0:01:35	0.3%	0:02:40	0.7%	--	--	--	--	--	--	--	--	--	--	--	--
Shared-ride shuttle	--	--	--	--	--	--	--	--	--	--	--	--	N/A	0.4%	N/A	0.1%
Hotel/motel shuttle	--	--	--	--	--	--	--	--	--	--	--	--	0:01:22	30.3%	0:01:45	24.0%
Off-Airport parking shuttle	--	--	--	--	--	--	--	--	--	--	--	--	0:01:16	23.7%	0:01:42	20.7%
Public transit bus	0:00:28	0.3%	0:00:39	0.7%	--	--	--	--	--	--	0:05:18	0.7%	0:04:51	2.0%	0:04:31	1.0%
Green lot bus	--	--	--	--	--	--	--	--	--	--	--	--	0:01:43	6.4%	0:02:13	4.2%
Rental car bus	--	--	--	--	--	--	--	--	--	--	--	--	0:04:45	24.1%	0:05:34	21.2%
Private vehicle	0:01:39	90.9%	0:01:39	91.2%	0:04:43	87.9%	0:06:01	96.6%	0:02:35	51.2%	0:07:56	73.2%	--	--	--	--
Other (police, delivery)	0:06:29	1.1%	0:01:26	0.3%	0:09:16	11.2%	0:17:15	3.4%	0:02:46	48.8%	0:02:00	26.1%	N/A	5.0%	N/A	5.4%

Note: Vehicle split is calculated as an average.

N/A = Not applicable. Dwell time in the taxi queues was not recorded.

Source: Advanced Geomatics, January 27 to 28, 2016, for AM Peak Period of 5:30 a.m. to 8:30 a.m. and PM Peak Period of 6:00 p.m. to 9:00 p.m.

Table 4-24

PEAK PERIOD VEHICLE FLEET MIX AND AVERAGE DWELL TIME – NORTH TERMINAL

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

	Departures				Arrivals				GTC			
	AM		PM		AM		PM		AM		PM	
Vehicle Class	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent	Average dwell time	Percent
Taxicab	0:03:53	1.0%	--	--	--	--	--	--	N/A	0.4%	N/A	4.5%
Limousine	0:05:14	0.4%	--	--	--	--	--	--	--	--	--	--
Shared-ride shuttle	--	-	--	--	--	--	--	--	N/A	0.6%	N/A	0.3%
Hotel/motel shuttle	--	--	--	--	--	--	--	--	0:01:31	33.4%	0:01:37	28.0%
Off-Airport parking shuttle	--	--	--	--	--	--	--	--	0:01:19	23.7%	0:02:39	26.8%
Public transit bus	0:01:43	0.4%	--	--	--	--	--	--	0:08:03	2.6%	0:09:01	2.4%
Green lot bus	--	--	--	--	--	--	--	--	0:02:30	6.3%	0:05:13	5.8%
Rental car bus	--	--	--	--	--	--	--	--	0:07:03	27.0%	0:05:07	27.9%
Private vehicle	0:01:48	96.4%	0:02:22	98.9%	0:08:24	92.7%	0:05:17	97.2%	--	--	--	--
Other (police, delivery)	0:02:48	1.8%	0:01:57	1.1%	0:04:14	7.3%	0:03:29	2.8%	N/A	6.0%	N/A	4.3%

Note: Vehicle split is calculated as an average.

N/A = Not applicable. Dwell time in the taxi queues was not recorded.

Source: Advanced Geomatics on January 25 to 26, 2016 for AM Peak Period of 5:30 a.m. to 8:30 a.m. and PM Peak Period of 6:00 p.m. to 9:00 p.m.

At the North Terminal Departures Level, the longest average dwell time observed was for limousines in the morning peak period at five minutes and fourteen seconds. Public transit buses had the lowest average dwell time at one minute and forty-three seconds. Overall, the average dwell times of private vehicles observed in the morning was approximately one minute longer than the average dwell time of private vehicles observed in the evening. On the Arrivals Level, dwell times were longer in the morning than in the evening for both private vehicles and other vehicles. The average dwell time for private vehicles in the morning was approximately eight and a half minutes while in the evening it was approximately five minutes.

4.4.5.5 Pedestrian Activity

Pedestrian bridges connect each terminal to its respective garage and GTC. As a result, there are no pedestrian crosswalks across the curbsides. To travel from terminal to terminal, there is an inter-terminal shuttle that departs every ten minutes from each GTC and the Westin Hotel entrance.

4.4.6 Ground Transportation Centers

The garages at each passenger terminal include a GTC to accommodate courtesy shuttles (rental car, hotel, and off-Airport parking), Airport shuttles, public transit, taxis, and other charter services.

4.4.6.1 McNamara Terminal Ground Transportation Center

Figure 4-23 shows the allocation of space and curb frontage at McNamara Terminal GTC. The GTC is located on the fourth level of the McNamara Parking Garage, corresponding with the arrivals level of the terminal. Curbside frontage includes 275 feet for a pickup area for Metro Cab, Metro Car, or prearranged rides; 75 linear feet for terminal shuttles; 125 feet for courtesy shuttles; 125 feet for a prearranged queue; 125 feet for a Metro Cab queue; 125 feet for a Metro Car queue; 125 feet for rental car shuttles; and 125 feet for public transit and charters. Table 4-21 shows the curb dwell time and vehicle fleet mix at the McNamara Terminal GTC.

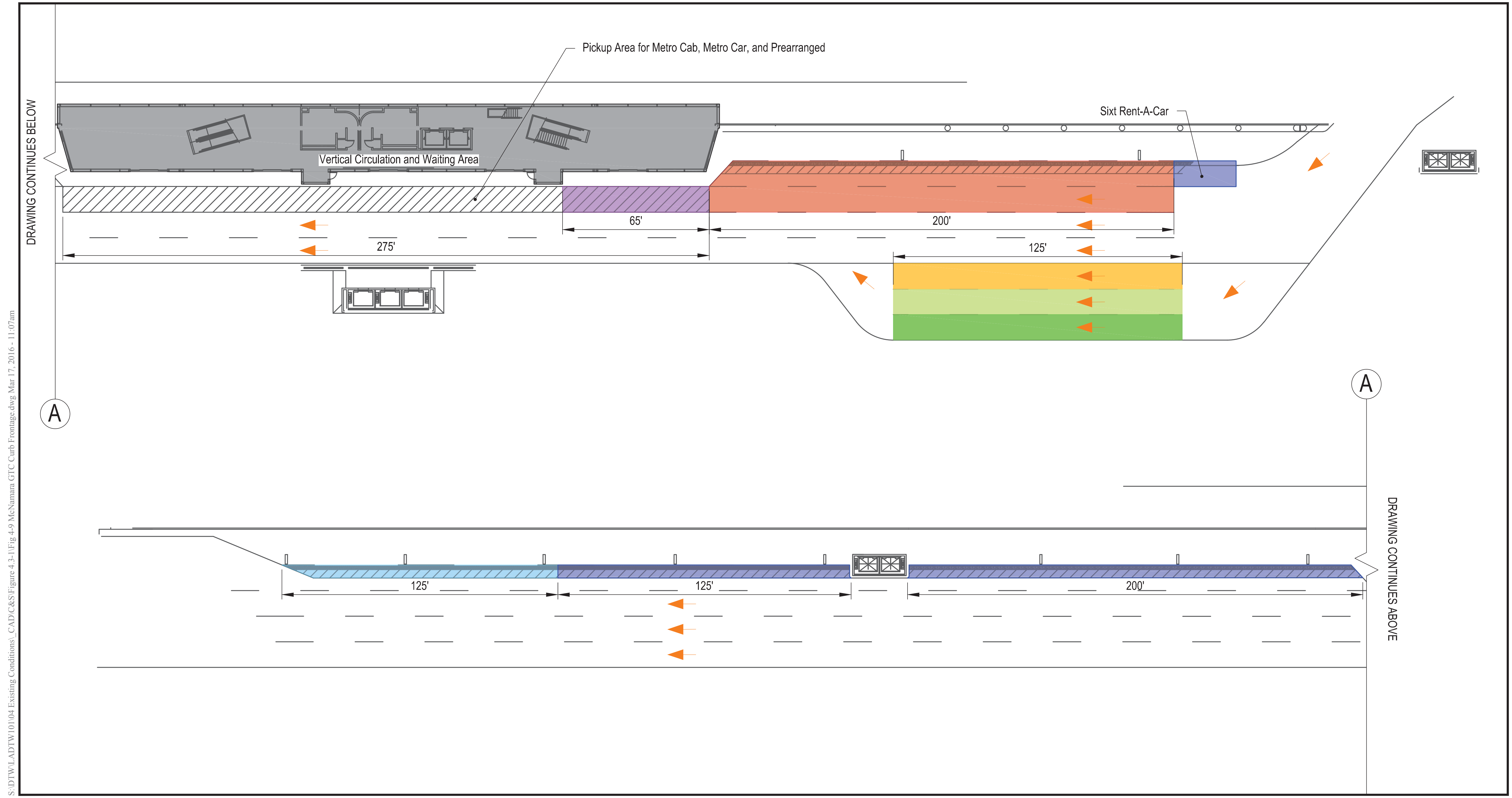
The McNamara GTC activity was primarily dominated by hotel/motel shuttles, off-Airport parking shuttles, and rental car buses in the morning. In comparison, during the evening peak period approximately 15% more taxicabs were observed. The longest average dwell time recorded at the McNamara GTC was rental car buses in the morning at approximately five minutes. In the evening, rental car buses had an average dwell time of approximately five and a half minutes.

4.4.6.2 North Terminal Ground Transportation Center

Figure 4-22 shows the allocation of space and curb frontage at the North Terminal GTC. The GTC is located on the lower level of the terminal, adjacent to the Big Blue Deck Parking Garage. Curbside frontage includes 500 linear feet of space dedicated to rental car shuttles and 350 feet of space dedicated to off-Airport parking and hotel shuttles. Table 4-22 shows the curb dwell time and vehicle fleet mix at the North Terminal GTC.

In the morning, the North GTC activity was predominantly rental car buses, hotel/motel shuttles, and off-Airport parking shuttles. In the evening, the North Terminal GTC was similar with a slight increase in taxicab activity with approximately 4% more taxicabs observed and 5% fewer hotel/motel shuttles.

The longest average dwell time observed at the North Terminal GTC was approximately nine minutes for public transit buses in the evening, one minute longer than the morning average dwell time. Average dwell times were also observed to be longer in the evening for hotel/motel shuttles, off-Airport parking shuttles, and green lot shuttles. Only rental car buses displayed a longer morning than evening dwell time at the GTC.



LEGEND

- Direction of flow
- Public transit and charters
- Rental car shuttle
- Inter-terminal shuttle
- Hotel and off-airport parking shuttle
- Metro Cab queue
- Metro Car queue
- Prearranged queue

NORTH

0 20' 40' 80'

Figure 4-23
McNAMARA TERMINAL
GROUND TRANSPORTATION CENTER

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

LeighFisher

4.4.7 Curbside and Ground Transportation Center Level-of-Service

The Level-of-Service (LOS) analysis was conducted using the Quick Analysis Tool for Airport Roadways, developed as part of the Airport Cooperative Research Program (ACRP), Report 40. The key inputs for the analysis included the peak hour traffic volumes and the estimated dwell times and are based on conditions and observations from January 22 to 30, 2016. It is assumed that conditions are worse during peak months. LOS D or better are assumed to be acceptable. A summary of LOS for key curbside areas is presented in Table 4-25 and the full analysis is provided in Appendix E.

At the North Terminal, the Upper Level Departures curbside operates at LOS C. The analyzed curbside was assumed to include only the portion of the curbside covered by a canopy, although additional uncovered curbside is available. The Lower-Level Arrivals curbside operates at LOS F, primarily due to average dwell times exceeding five minutes. The GTC curbside at the North Terminal is split into two zones. The courtesy shuttle zone operates at LOS A and the RAC shuttle zone operates at LOS D, primarily because the RAC shuttles typically operate on a bump-and-run schedule.

At the McNamara Terminal, the Upper Level Departures curbside operates at LOS C. The Middle Level Arrivals curbside operates at LOS E, primarily due to average dwell times exceeding six minutes. The Lower Level International Arrivals curbside operates at LOS F. The peak hour dwell times at the International Arrivals curbside are close to national average at 2.5 minutes, but the available curbside is limited and often used by emergency and Customs and Border Protection vehicles. The curbside at the McNamara GTC has various zones. The courtesy shuttle zone operates at LOS D. The rental car shuttle zone technically operates at LOS F, although this is due to the bump-and-run operation used by the rental car operators, so the unacceptable LOS does not impact the overall operation of the GTC.

Table 4-25
PEAK-HOUR CURBSIDE AND GTC LEVEL OF SERVICE – JANUARY 2016
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Curbside length	Peak hour *(a)*	Volume	Level-of-service *(b)*
North Terminal				
Upper Level – Departures	740 *(c)*	5:15 a.m. Monday	461	C
Lower Level – Arrivals	830	11:30 p.m. Sunday	536	F
Ground Transportation Center	850	4:00 p.m. Monday	204	D
McNamara Terminal				
Upper Level – Departures	985	6:15 a.m. Monday	772	C
Middle Level – Arrivals	950	8:45 p.m. Sunday	524	E
Lower Level – Arrivals	420	6:15 a.m. Monday	624	F
Ground Transportation Center	1,010	4:15 p.m. Monday	277	D

(a) Peak hours identified from traffic counts conducted from 1/23/16 through 1/31/16.
(b) Level-of-service identified using the Quick Analysis Tool for Airport Roadways, developed as part of Airport Cooperative Research Program – Report 40.
(c) The total available curbside at the North Terminal Upper Level is 1,200 feet, but most activity occurs on the curbside covered by the canopy (740 feet).

Source: LeighFisher, February 2016.

4.4.8 Parking Facilities

The following summarizes on- and off-Airport public and employee parking facilities as shown in Figure 4-15.

4.4.8.1 On-Airport Public Parking

On-Airport public parking is currently available in garages at both the McNamara Terminal and North Terminal. The McNamara Terminal provides a 10-level garage containing long-term parking for 8,690 vehicles and short-term parking for 723 vehicles. This garage also provides valet parking. The Big Blue Deck, a six-level garage, provides public parking at the North Terminal. Big Blue Deck provides long-term parking for 5,958 vehicles and short-term parking for 203 vehicles. The Airport also provides electric vehicle charging stations at both terminals. Six electric vehicle parking spaces are located on Level 4 of Big Blue Deck and on Level 8 of the McNamara Garage.

The Airport also provides additional public parking for a flat daily rate at two surface lots located near the North Terminal. Green Lot 1 contains 1,517 long-term parking spaces and Green Lot 2 contains 896 economy and short-term spaces available for public use. Free continuous shuttles are available to both the North and McNamara Terminals from these lots.

In addition, two cell phone lots are available near the northern and southern entrances of the Airport. These lots were created as part of an initiative to reduce curbside waiting at the Airport. The South Cell Phone Lot includes two electric vehicle spaces. Table 4-26 summarizes parking availability for each facility.

Table 4-26
ON-AIRPORT PUBLIC PARKING FACILITIES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Facility	Regular	Accessible
Surface Lots		
Green Lot 1	1,481	36
Green Lot 2	876	20
Total	2,357	56
Garages		
Big Blue Deck Long Term	5,824	134
Big Blue Deck Short Term	196	7
McNamara Garage Long Term	8,550	140
McNamara Garage Short Term	707	16
Valet	333	N/A
Total	15,610	297
Cell Phone Lots		
North Cell Phone Lot	37	N/A
South Cell Phone Lot *(a)*	47	N/A
Total	84	N/A
Grand Total	18,051	353

Source: 2013 Surface Parking Analysis Report, Wayne County Airport Authority and C&S Engineers, Inc. field inventory.

The Airport includes an average of 541 parking spaces for every million passengers, which is below the regional average of 558 spaces. In 2009, the terminal short-term parking rate was $25.00 per day ($3.05 above the regional average). The long-term parking rate for one week was $112.00 ($21.24 above the regional average).* Daily rates have increased since 2009, and are shown in Table 4-27.

Table 4-27
2015 ON-AIRPORT PUBLIC PARKING RATES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Facility	Daily maximum
McNamara Garage	
Short term	$31.00
Long term	$23.00
Valet	$38.00
Big Blue Deck	
Short term	$31.00
Long term	$13.00
Surface Lots	
Green Lot 1	$11.00
Green Lot 2	$11.00

Source: Detroit Metropolitan Wayne County Airport website.

Historical transactions and parking revenues for on-Airport public surface lots and garages are summarized for FY 2010-2015 in Table 4-28. Monthly transactions for FY 2015 are summarized per public parking facility on Figure 4-24. Long-term parking grosses the highest amount of transactions compared to other types of parking. The McNamara Parking Garage also generates a greater number of transactions than the Big Blue Deck for both short- and long-term parking, although monthly transaction trends between both facilities are consistent. Green Lots 1 and 2, which both have a flat daily parking rate of $11.00, generate the least number of transactions. Records for Green Lot 2 indicate only three transactions for FY 2015. Green Lot 2 did not generate any transactions for the months of October, November, June, and September.

For each day of the year, the Airport calculates the number of transactions and revenue generated at each type of parking facility. Over the period between October 2014 and September 2015, the month of March generated the highest revenue. Table 4-29 presents the highest overnight occupancy day, and the 10th, 20th, and 30th highest overnight occupancy days experienced during this month for each parking facility.

4.4.8.2 Off-Airport Public Parking

There are four privately-operated off-Airport parking facilities in operation since 2004: Qwik Park (and Qwik Park's overflow lot), Airlines Parking, Park-N-Go, and US Park. Combined, these operators have an inventory of approximately 18,950 parking spaces. Although each off-Airport parking facility is not required to pay the Airport a percentage of their gross fees, they are required to pay a monthly access fee of $780 per space. The name, location, and approximate capacity (estimated from aerial imagery and interviews with facility managers), are presented in Table 4-30.

*Airport Service Quality, Benchmarking the Global Airport Industry-Best Practice Report Parking Facilities, ACI 2009.

Table 4-28

HISTORICAL PUBLIC PARKING ANNUAL TRANSACTIONS AND REVENUES

Airport Master Plan Update

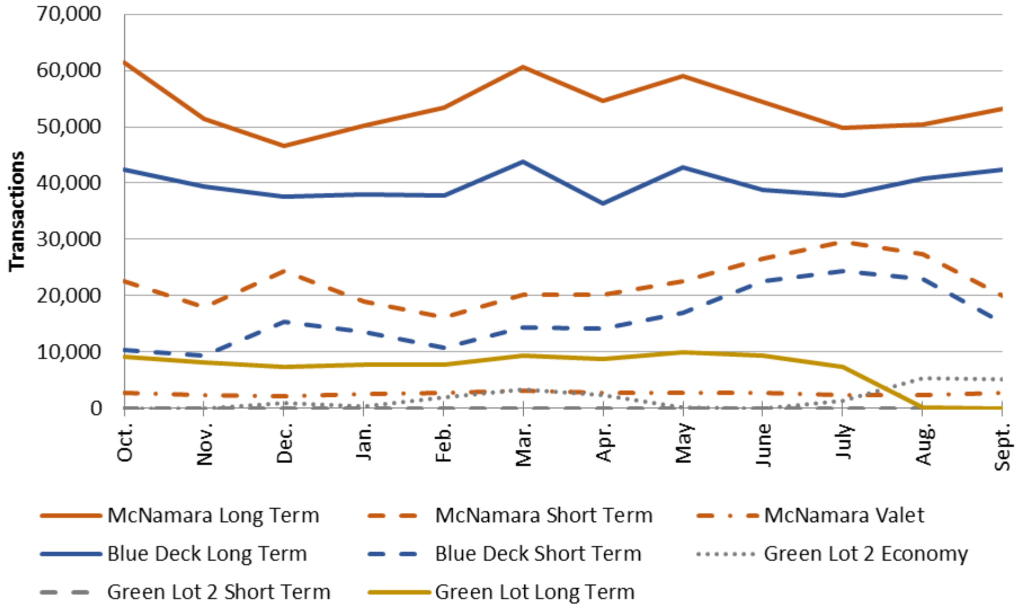
Detroit Metropolitan Wayne County Airport

Facility	Parking product	Revenue/ transaction	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
McNamara Garage	Long Term	Revenue	$40,011,276	$42,075,745	$44,324,694	$41,948,599	$46,308,462	$49,305,266
		Transactions	622,857	642,226	667,136	614,533	656,529	647,798
	Short Term	Revenue	$4,187,623	$4,290,188	$4,373,206	$4,258,452	$4,944,657	$5,276,679
		Transactions	353,297	321,768	301,422	286,078	265,070	266,394
	Valet	Revenue	$2,094,309	$2,205,645	$2,326,008	$2,333,443	$2,866,003	$3,211,758
		Transactions	24,428	24,941	26,092	25,120	29,744	31,144
	APS	Revenue	$0	$0	$5,451	$0	$0	$0
		Transactions	0	0	54	0	0	0
Big Blue Deck	Long Term	Revenue	$11,962,694	$14,984,814	$16,426,315	$15,567,736	$17,927,552	$20,677,954
		Transactions	327,230	456,765	485,063	446,613	503,148	478,780
	Short Term	Revenue	$1,143,242	$1,092,827	$1,113,531	$1,019,653	$1,215,556	$1,639,604
		Transactions	168,993	163,195	162,005	142,048	151,729	189,999
	Economy	Revenue	$0	$0	$2,540	$0	$0	$0
		Transactions	0	0	418	0	0	0
Yellow Lot & Green Lot 2	Economy	Revenue	$3,073,033	$1,524,234	$218,120	$32,826	$174,276	$1,059,736
		Transactions	60,917	34,850	4,056	822	4,797	21,042
	Short Term	Revenue	$0	$2,648	$0	$0	$0	$144
		Transactions	0	70	0	0	0	3
Green Lot 1	Long Term	Revenue	$0	$2,579,344	$3,713,712	$3,452,376	$4,348,770	$4,241,308
		Transactions	0	58,394	87,767	79,806	97,452	85,420
All Facilities	Total	Revenue	$62,472,177	$68,755,445	$72,503,577	$68,613,085	$77,785,276	$85,412,449
		Transactions	1,557,722	1,702,209	1,734,013	1,595,020	1,708,469	1,720,580
	Daily Average	Revenue	$171,627	$188,371	$199,734	$204,815	$213,696	$234,007
		Transactions	4,279	4,664	4,777	4,761	4,694	4,714

(a) Data missing/incomplete for dates: 10/1/09, 10/1/11, 10/2/11, 9/1/13 to 9/30/13, 10/1/13, 4/29/15 to 4/30/15.
(b) Yellow Lot closed in September 2011 (except for holidays and spring break) and closed permanently in April 2012.

Source: Detroit Metropolitan Wayne County Airport website.

Figure 4-24
FY 2015 MONTHLY PUBLIC PARKING TRANSACTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Note: No transactions were reported in 2015 for McNamara APS and Big Blue Deck Economy.
Source: Revenue Reports, September 2011, 2013 and 2015, Wayne County Airport Authority.

Table 4-29
ON-AIRPORT OVERNIGHT PARKING OCCUPANCIES (MARCH 2015)
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Facility	Highest day	10th highest day	20th highest day	30th highest day
McNamara	7,777	7,117	5,125	4,430
Big Blue Deck	4,978	4,728	4,421	3,798
Green Lot	1,477	1,442	1,373	1,290
Total	14,232	13,287	10,919	9,518

Source: Parking Lot Car Count Report 2015, Wayne County Airport Authority, March 2015, 4 a.m. Count.

Table 4-30
OFF-AIRPORT PUBLIC PARKING FACILITIES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Facility	Location	Approximate capacity
Qwik Park (including overflow)	7782 Merriman Rd	7,300
Airlines parking	8325 Merriman Rd	5,900
Park-n-Go	31555 Wick Rd	750
US Park	9601 Middle Belt Rd	5,000
Total		18,950

Source: C&S Engineers, Inc., February 2016.

4.4.8.3 Employee Parking

The Airport currently provides approximately 6,000 employee parking spaces at four separate locations. The South Lot is designated an employee-only surface lot with approximately 4,500 spaces, situated off of Eureka Road just east of the South Airport Entrance. Other primary locations for employee parking are the McNamara Parking Garage, which contains approximately 780 designated employee parking spaces, and the Big Blue Deck Parking Garage, which contains approximately 440 designated employee parking spaces. There are also parking lots adjacent to the L.C. Smith Terminal with approximately 220 spaces and 172 parking spaces in Lots L-17 and L-19 outside of Building 610, which is currently Public Safety Headquarters. These spaces accommodate visitors to the nearby buildings and Authority employee permit holders.

4.4.9 Rental Car Facilities

The rental car complex is located in the northeast corner of the Airport, near the 21R Runway threshold. The complex is bound by Goddard Road (North), Middlebelt Road (East), and East Service Drive (West). Lucas Drive bisects the rental car complex and provides the primary access and egress to each of the on-Airport rental car sites. There are six on-Airport rental car sites (Budget-Payless, Hertz-Firefly, Avis, Alamo-National, Dollar-Thrifty, and Enterprise) and one off-Airport rental car site (Sixt). The locations of the rental car sites are depicted on Figure 4-25. A summary of the building-space, equipment, and vehicle parking stalls in Airport sites is in Table 4-31.

All rental car facilities are accessed by arriving passengers by following signage to each terminal's GTC and then riding the rental car company's shuttle. Shuttle service can also be requested for rental car customers by utilizing the rental car operators' courtesy phones located inside each terminal's baggage claim hall and the GTC. Approximate travel time from the GTC to the rental car complex ranges from four to eight minutes. Most rental car companies operate two independent shuttle routes, one for each terminal.

Customers returning their vehicles access Lucas Drive via the East Service Road to the west or Middle Belt Road to the east. Each rental car facility operates a shuttle that utilizes Lucas Drive, Goddard Road, and W. G. Rogell Drive to access the GTC for each terminal as shown on Figure 4-25.

Figure 4-25
RENTAL CAR AREA

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

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Table 4-31
ON-AIRPORT RENTAL CAR SITE INVENTORY
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Total acres	**64.9**
Customer service / employee areas	
Employee / visitor parking spaces (stalls)	565
Employee / visitor parking area (acres)	4.2
Customer service area / administrative offices	1.3
Total customer service / employee area (acres)	5.4
Ready return spaces	
Ready parking spaces (stalls)	1,437
Return parking spaces (stalls)	1,838
Total ready-return area (acres)	19.4
Service areas (Quick-turn around)	
Fueling and washing	1.9
Maintenance	1.3
Stacking, staging and storage	18.7
Total service area (acres)	22.0
Additional support areas/circulation (acres)	18.0

Source: LeighFisher, based on rental car questionnaire, February 2016.

4.4.10 Public Transit

Two public transit services from the surrounding region provide service to the Airport. Suburban Mobility Authority for Regional Transportation (SMART) provides service from downtown Detroit, Melvindale, River Rouge, Ecorse, Lincoln Park, Southgate, and Southland Center. As of 2015, SMART's average weekday ridership for fixed and connector routes is at 36,000 passengers. A detailed ridership survey was conducted in 2011 detailing passenger boardings, passenger maximum load, and the percentage of buses arriving on time. These results are summarized in Table 4-32. Figure 4-26 presents summary data on peak boarding periods for both routes that serve the Airport.

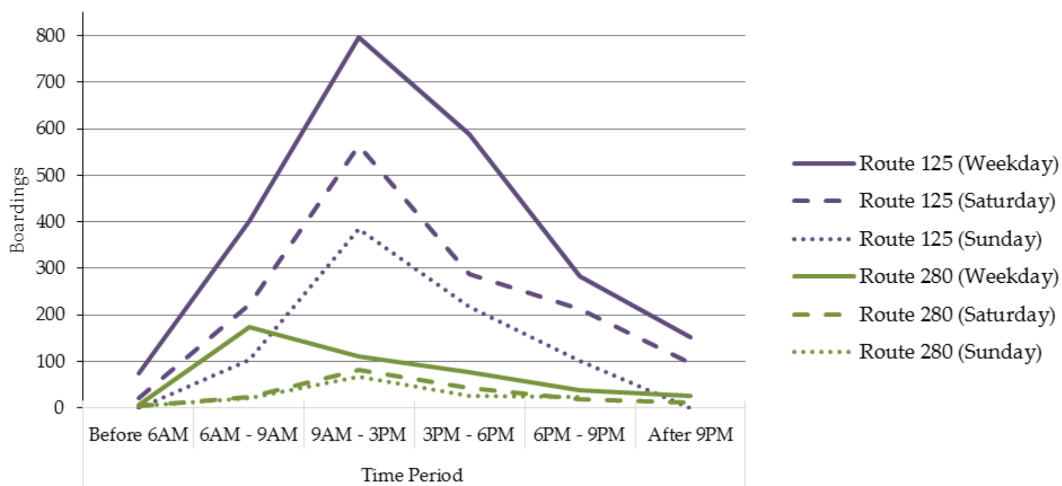
The other public transit service providing access to the Airport is the 2012 partnership between Ann Arbor Transportation Authority ("The Ride") and Michigan Flyer. This partnership provides public transit service via Route 787 (AirRide) to and from the GTCs to stations in the Ann Arbor Area, which provide connections to points throughout Washtenaw County and the SMART bus system for Wayne, Oakland, and Macomb counties. Blake Transit Center and Kensington Court Hotel are stops along this route that provide parking for passengers going to the Airport. In 2015, AirRide had a ridership of 72,394 passengers.

Table 4-32
SMART RIDERSHIP (2011)
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Day	Boardings	On time percentage	Maximum load
		Route 125	
Weekday	2,293	70.3%	44
Saturday	1,403	62.4%	32
Sunday	807	73.1%	36
		Route 280	
Weekday	331	90.4%	15
Saturday	182	84.6%	11
Sunday	139	85.9%	11

Source: SMART and AJM Consulting, *Executive Summary for the Conduct of a Passenger Count for Suburban Mobility Authority for Regional Transportation*, 2011.

Figure 4-26
SMART RIDERSHIP (2011)
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: SMART and AJM Consulting, *Executive Summary for the Conduct of a Passenger Count for Suburban Mobility Authority for Regional Transportation*, 2011.

4.5 AIR CARGO

The Airport accommodates exclusive air cargo operators and multiple airlines providing air cargo services. Approximately 38 acres of the Airport are designated for air cargo use.

4.5.1 On-Airport Air Cargo Facilities

The following summarizes on-Airport air cargo tenants and facilities, which are shown on Figure 4-27.

- **United Parcel Service** – United Parcel Service (UPS) operates a 305,671 square-foot cargo processing warehouse at the Airport (Building 427). This facility opened in 1991 and is located between Runway ends 27R and 27L. This facility handles packages and freight that are destined for and originate in the Detroit metropolitan area.

- **Delta Cargo** – Delta Cargo operates out of Building 536, an approximately 15,632 square-foot facility located adjacent to the Green Lot 2. This facility is currently constrained by the number of loading docks available. This building has land available for expansion through its leasehold. Delta Air Freight utilizes the adjoining facility (Building 536-A) to support its cargo operations. Delta Cargo and Swissport are the current tenants of Building 514, which is a 53,450 square-foot building currently under construction.

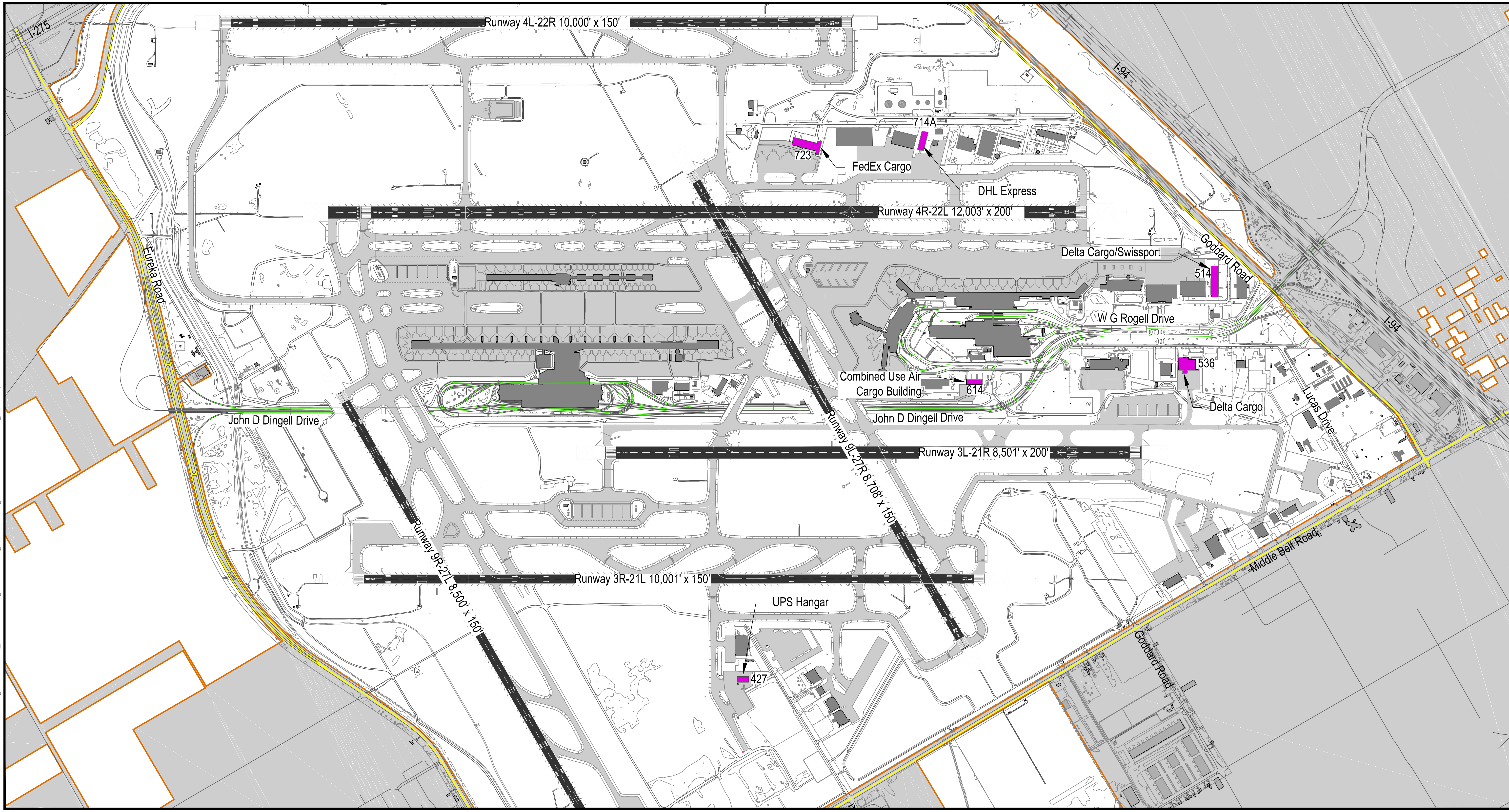
- **FedEx** – FedEx operates out of Building 723, which is accessible airside via Taxiway Z. The facility is 62,600 square-feet and includes a 224,075 square-foot apron. The facility has four spaces available for aircraft parking. The southernmost parking position is restricted to Airbus A310s and Boeing 757s aircraft. The future realignment of Taxiway Z will render the aircraft parking position angled to the building unusable. FedEx also subleases buildings 714, 714A, and 714B. Building 714 is an 8,400 square-foot facility primarily used for vehicle maintenance operations. Buildings 714A and 714B are not in use.

- **DHL Express** – DHL Express operates from Building 714A, which it shares with two other tenants (Spirit Airlines and FedEx). This facility is 30,566 square-feet and is accessible airside by Taxiway Z. Due to the lack of space at this facility, DHL Express stores most of its equipment outside behind Building 715 where it also utilizes one aircraft parking position for its daily operations.

- **Combined Use Air Cargo Building** – The North Terminal Combined Used Air Cargo Building (Building 614) is a 20,029 square-foot facility, accessible landside by East Service Drive. This building houses two cargo carriers: Southwest Airlines Cargo and Air General Inc.

4.5.2 Off-Airport Air Cargo

Lufthansa Cargo is a German cargo airline and a subsidiary of Lufthansa, the largest airline in Europe. Lufthansa Cargo offers worldwide air freight and logistics services. Lufthansa Cargo is located on Highland Road, approximately 0.2 miles west of the Airport.



LEGEND

Airport Property Line

Airport perimeter roadways

Primary access and terminal circulation

Air Cargo Tenant Locations

NORTH

0 750' 1500' 3000'

Figure 4-27
AIR CARGO TENANT LOCATIONS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

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4.6 GENERAL AVIATION

General aviation facilities are summarized in Table 4-33 and their locations are shown on Figure 4-28.

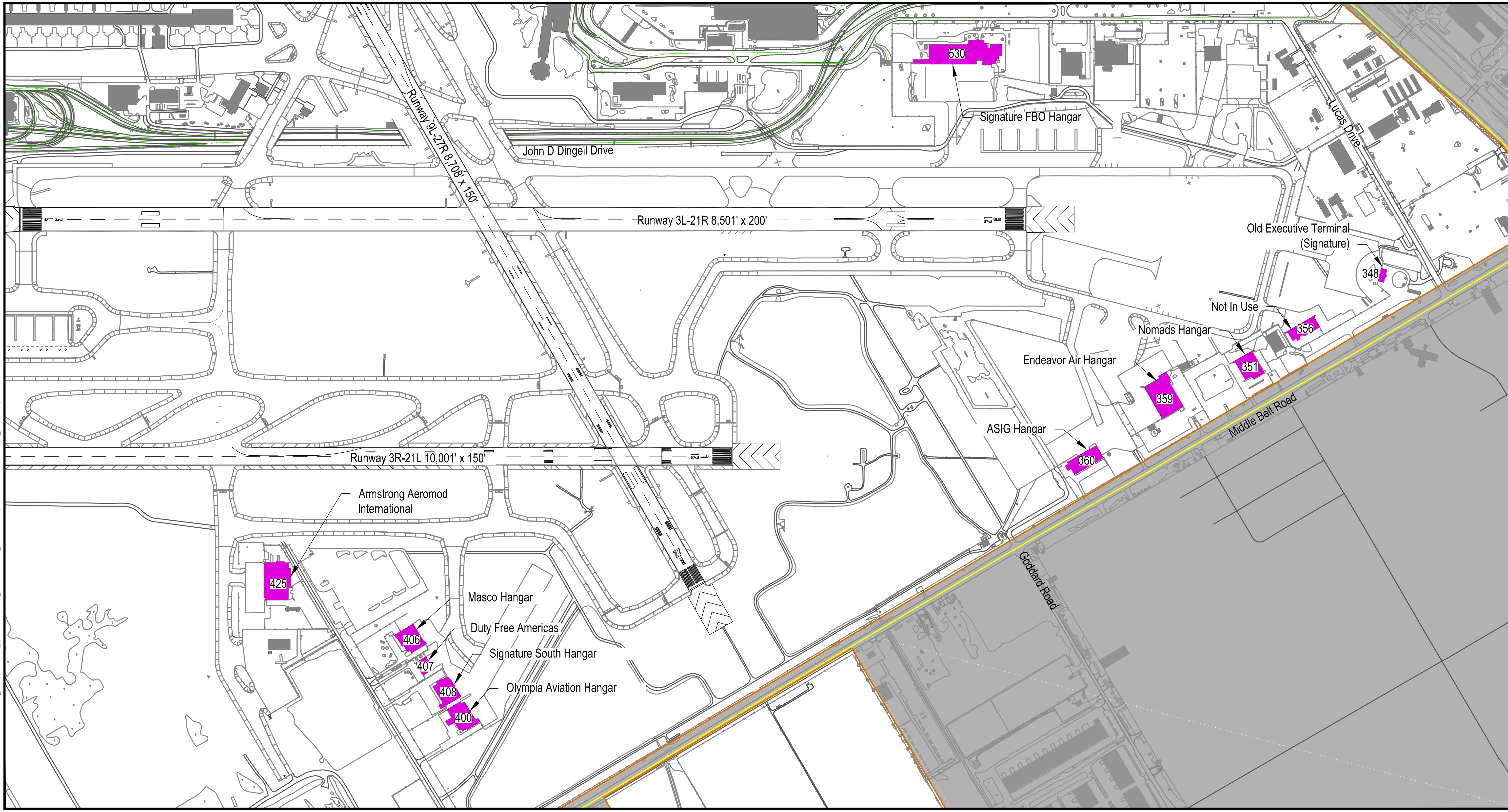
Table 4-33
GENERAL AVIATION HANGAR INVENTORY
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Facility number	Structure	Area (SF)	Constructed/ improvements	Owner
348	Old Executive Terminal	10,400	1938	Signature Flight
351	Nomads Hangar	32,136	1953; 2001 interior construction	WCAA Public Safety/HSS
356	Former GA Hangar	29,084	1975	Currently not in use
359	Endeavor Air Hangar	57,729	1961; 2001, 2007 tenant improvements	Endeavor Air/Delta
360	ASIG Hangar	33,096	N/A	ASIG/EPIC
400	Olympia Aviation Hangar	N/A	N/A	Olympia Air
406	Masco Hangar	37,140	1979; 2007 addition	Masco Flight Operations
407	Duty Free Americas	59,000	1978	Duty Free Americas
408	Signature South Hangar	23,623	1975	Signature Flight
425	Armstrong AeroMod International	30,171	1997	Armstrong AeroMod
530	Signature Hangar	110,516	1956; 2014 roofing improvement	Signature Flight

Source: C&S Engineers, Inc., Jan 2016, based on Wayne County Airport Authority Fixed Asset Database and field surveys.

Signature Flight Support is located in Building 530, adjacent to Green Lot 1. This building is 110,516 square-feet and located in a hangar. It offers features such as a crew lounge, hangar, and U.S. Customs. Services provided by Signature include: cabin cleaning, fueling, hangars, tie-downs, repairs, cargo services, deicing, and passenger services. Airfield access is provided via Taxiway M. Vehicular access is from East Service Road.

Other facilities used for general aviation purposes provide vehicle parking, aircraft storage, fueling, maintenance, warehousing, and office/meeting space.



LEGEND

Airport Property Line

Airport perimeter roadways

Primary access and terminal circulation

General Aviation and Fixed Based Operator Locations

NORTH

0 400' 800' 1600'

Figure 4-28

GENERAL AVIATION AND FIXED BASED OPERATOR LOCATIONS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

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4.7 AIRLINE AND AIRPORT SUPPORT

Airline and Airport support facilities and functions are described in the following sections.

4.7.1 Airline Support

Airline support facilities are dedicated to supporting passenger and cargo airline operations. These facilities include aircraft maintenance facilities, airline catering and flight kitchen services, ground service equipment (GSE) storage and maintenance, fuel farm, fuel storage and dispensing systems, deicing fluid containment, ground run-up enclosures (GRE), and triturators. The locations of airline support facilities are shown on Figure 4-29.

4.7.1.1 Aircraft Maintenance

Aircraft maintenance facilities provide a sheltered environment for the repair of aircraft and other airline equipment. Delta Air Lines is the primary tenant at the Airport with dedicated aircraft maintenance hangars. A new aircraft maintenance hangar for Spirit Airlines is expected to be completed in the near-term, and will be located adjacent to Building 715. Aircraft maintenance hangar areas and construction dates are summarized in Table 4-34.

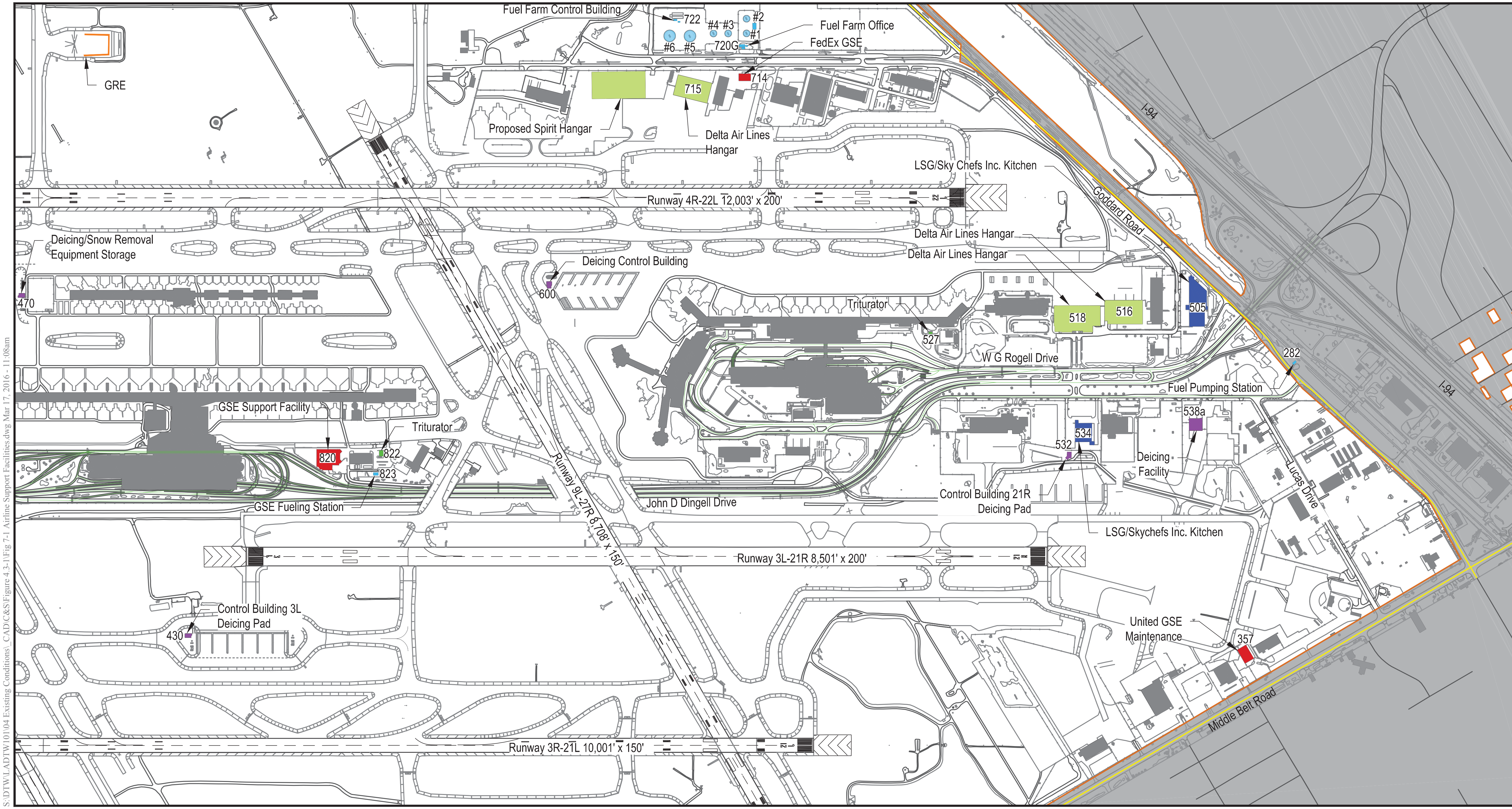
Table 4-34
AIRCRAFT MAINTENANCE FACILITIES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Facility number	Facility name	Area (SF)	Constructed/ improvements
516	Delta Air Lines Hangar	85,194	1998
518	Delta Air Lines Hangar	119,264	2002
715	Delta Air Lines Hangar	77,508	2011
N/A	Spirit Airlines Hangar	126,000	Anticipated 2016

Source: C&S Engineers, Inc., January 2016, based on Detroit Metropolitan Wayne County Airport Authority Fixed Asset Database.

4.7.1.2 Airline Catering and Flight Kitchen

LSG Sky Chefs, Inc. provides full catering and commissary services, including in-flight management and transportation of catered goods to and from aircraft. LSG Sky Chefs serves an average of 260 flights per day (approximately 10,000 meals). LSG Sky Chefs currently leases Building 505, a 72,928 square foot facility located on West Service Road near the North Terminal. However, this building is not easily accessible from the McNamara Terminal and the existing flight kitchen is expected to reach the end of its useful life in approximately eight years.



LEGEND

- Airport Property Line
- Airport perimeter roadways
- Primary access and terminal circulation
- Airline fuel facilities
- Airline catering/flight kitchen
- Deicing facility
- Ground Support Equipment (GSE)
- Ground Run-up Enclosure (GRE)
- Triturators
- Aircraft maintenance facilities

NORTH

0 500' 1000' 2000'

Figure 4-29
AIRLINE SUPPORT FACILITIES

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
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4.7.1.3 Fuel Storage and Dispensing System

The Airport has one main fuel farm currently operated by Delta Air Lines, which is located on Goddard Road on the northwest side of the Airport. Fuel is pumped from the fuel farm into fuel service vehicles and transported to service aircraft and Airport motor vehicles. Building 720 houses the fuel farm electrical equipment, Building 720G houses the fuel farm office, and Building 722 houses the fuel farm control building.

Fuel is stored in six above-ground tanks located immediately adjacent to these facilities (which are restricted to a height of 39 feet to ensure a clear line of view with the existing ATCT). The location of these tanks is shown on Figure 4-29 and their capacities are summarized in Table 4-35.

Table 4-35
DELTA FUEL TANK CAPACITY
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Tank number	Building	Capacity (Gallons)
1	720A	840,000
2	720B	840,000
3	720C	840,000
4	720D	840,000
5	720E	2,500,000
6	720F	2,500,000

Source: Detroit Metropolitan Wayne County Airport Authority Fixed Asset Database.

The North Terminal was outfitted with a hydrant fueling system during construction in 2006. This system consists of a network of underground pipes that deliver fuel from the fuel farm directly to the gates at the terminal. This system reduces operational emissions and eliminates the need for fuel service trucks at the terminal. Twelve pumps and two pipelines feed the hydrant system, which is controlled by an automated fuels management system.

Fueling stations for ground support equipment are also available in two locations on the Airport. Building 823 is located immediately off of John D. Dingell Drive before the entrance to the McNamara Garage. These fueling stations draw fuel from one 30,000 gallon underground storage tank and one 15,000 gallon underground storage tank. The second location, Building 472, houses four underground storage tanks. Two tanks each have a capacity of 30,000 gallons for gasoline and two smaller tanks each have a capacity of 15,000 gallons of diesel.

An additional fuel pumping station with underground storage tanks is located at Building 282 on Goddard Road.

4.7.1.4 Deicing Fluid Operations and Containment

The Airport operates the largest aircraft deicing fluid (ADF) management system in the world. It has 27 deicing positions at four locations on the airfield, including deicing pads near the Runway 4R and 3L ends (used for Delta Air Lines mainline aircraft); the Runway 22L end (used by Delta Air Lines RJs; the Runway 21R end (used by North Terminal airlines). Information on deicing control facilities are summarized in Table 4-36.

Deicing pads are equipped with confined drainage systems that collect and separate used glycol from stormwater runoff. High concentrate runoff passes through pavement grates to underground storage tanks near the deicing pad. From there, all high-concentrate ADF runoff is recycled. For more dilute concentrate, once the glycol level in these tanks has decreased to an acceptable level, it is conveyed to Glycol Storage Pond 3W (West) for storage and eventual discharge into the storm water system.

Since 2013, the Airport has utilized two wastewater treatment facilities to manage discharges. When temperatures are high, the Downriver Wastewater Treatment Facility in Wyandotte, Michigan is utilized, although the facility has limited ability to treat biochemical oxygen demand (BOD). During colder temperatures, the Detroit Water and Sewerage Department Treatment Plant is utilized given its higher BOD treatment capacity.

Delta Air Lines recently implemented a Blend-to-Temperature ADF Application System at the Airport through its partnership with Integrated Deicing Services (IDS), which is located in the 17,066 square-foot Building 538-A. This partnership with IDS allows for ADF ratios to be used in "real time" so that operations can be monitored live through interactions with the deicing control buildings. The deicing control buildings provide instant feedback on deicer spray performance so that deicing fluids can be blended to match the weather for temperatures needed to protect the aircraft. Overall, this creates a reduction in ADF and reduces operating costs.

Table 4-36
DEICING CONTROL FACILITIES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Building	Use	Owner	Area (SF)	Date constructed
430	Control Building at 3L deicing pad	Delta	5,004	2001
470	Control Building at 4R deicing pad and snow removal equipment storage	Delta	4,136	1980
532	Control Building at 21R deicing pad	IDS	3,424	2001
600	Control Building	IDS	1,700	2003

Source: C&S Engineers, Inc., based on Wayne County Airport Authority Fixed Asset Facilities Inventory and field surveys.

4.7.1.5 Ground Run-Up Enclosures

In 2012 the Airport implemented a 90,000 square-foot, three-sided, 42 foot-tall ground run-up enclosure (GRE) to reduce noise created by aircraft run-up operations. The GRE is currently the largest in North America and can reduce noise exposure from 20 square miles to 2.2 square miles. The GRE is currently utilized an average of three times per day.

4.7.1.6 Airline Waste Triturator

There are two airline waste triturators (waste processors) located at the Airport. Building 527 is a 510 square-foot facility that services lavatory trucks for the North Terminal. Building 822 is a 600 square-foot facility that services lavatory trucks at McNamara Terminal.

4.7.1.7 Ground Support Equipment Storage

Ground support equipment (GSE) storage and support facilities are summarized in Table 4-37.

Table 4-37
AIRLINE GSE SUPPORT FACILITIES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Facility number	Facility name	Area (SF)	Constructed/ improvements
357	United Airlines GSE	16,285	N/A
714	FedEx GSE	8,400	1982
820	GSE Support Facility	N/A	N/A

Source: C&S Engineers, Inc., January 2016, based on Detroit Metropolitan Wayne County Airport Authority Fixed Asset Database.

4.7.2 Airport Support

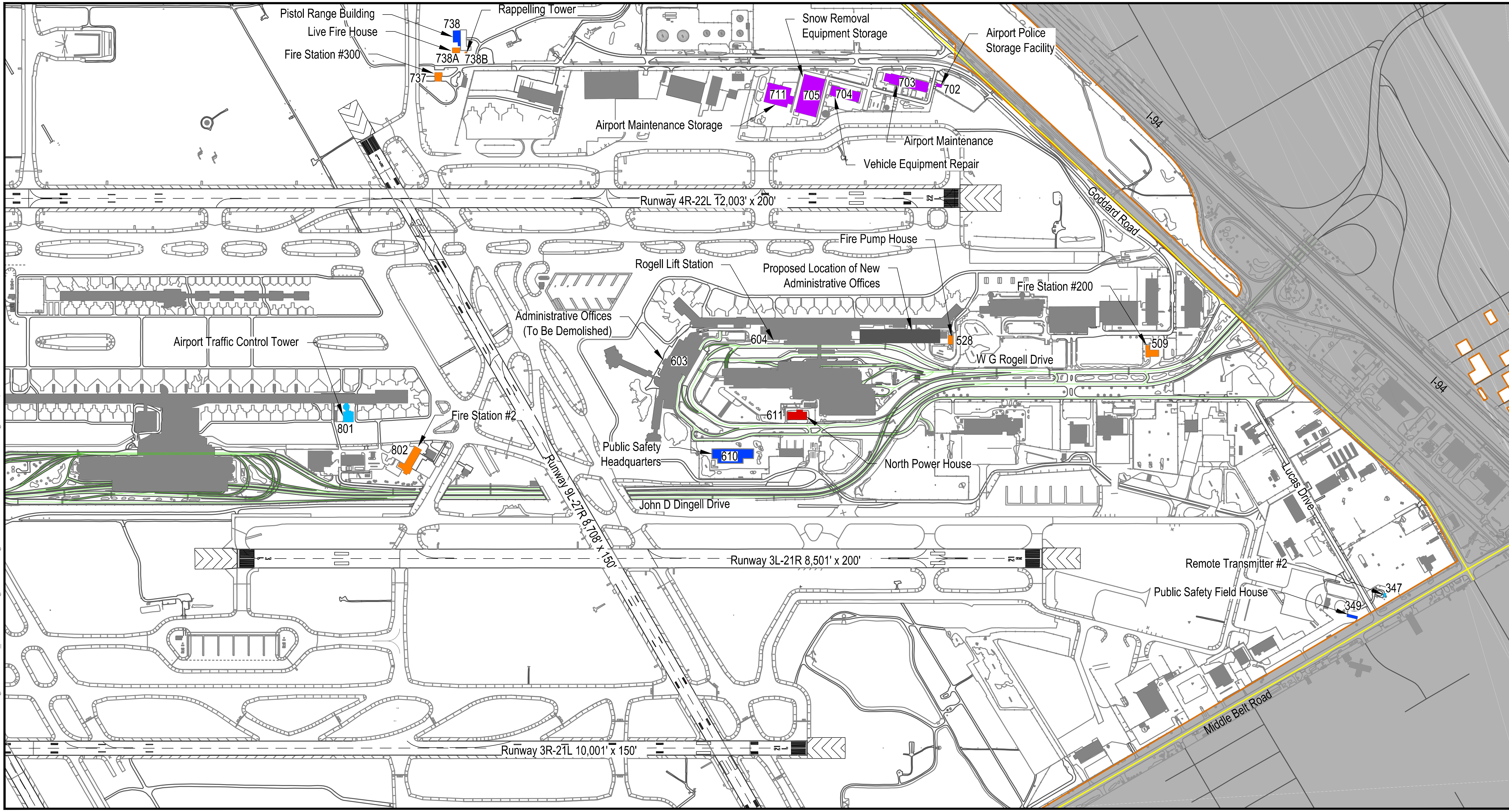
Airport support facilities are shown on Figure 4-30 and summarized in the following sections.

4.7.2.1 Wayne County Airport Authority Offices

Airport Authority administrative offices are located in Building 603 at the L.C. Smith Terminal. The Authority has plans to construct new office space located on the north side of the North Terminal.

4.7.2.2 Airport and Airfield Maintenance

The Airport's Maintenance and Fleet Services Department is comprised of four branches: Maintenance Administration, Facilities Maintenance, Field Maintenance, and Fleet Services. The majority of maintenance and fleet service facilities are located off the West Service Road in the northwest corner of the Airport. Table 4-38 summarizes Airport and airfield maintenance facilities.



LEGEND

- Airport property line
- Airport perimeter roadways
- Primary access and terminal circulation
- FAA facilities
- Public safety
- Maintenance
- Electrical
- Aircraft Rescue and Fire Fighting (ARFF)

NORTH

0 500' 1000' 2000'

Figure 4-30
AIRPORT SUPPORT FACILITIES

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
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Table 4-38
AIRPORT AND AIRFIELD MAINTENANCE FACILITIES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Facility number	Facility name	Area (SF)	Constructed/ improvements
703	Airport Maintenance	62,939	1993/2009
704	Vehicle Equipment Repair	30,709	1993/2002
705	Snow Removal Equipment Storage	90,505	1989/2013
711	Previous Northwest Hangar	44,307	1965

Source: C&S Engineers, Inc., January 2016, based on Detroit Metropolitan Wayne County Airport Authority Fixed Asset Database.

4.7.2.3 Public Safety and Airport Police

The Airport Police Department is responsible for law enforcement duties, but also provides support to the TSA by responding to passenger screening. The Wayne County Department of Public Safety Field House is located at Building 349 on Middle Belt Road and the Public Safety Headquarters is located at Building 610 on the East Service Dive. Authority Public Safety and HSS (non-TSA security) occupies Building 351.

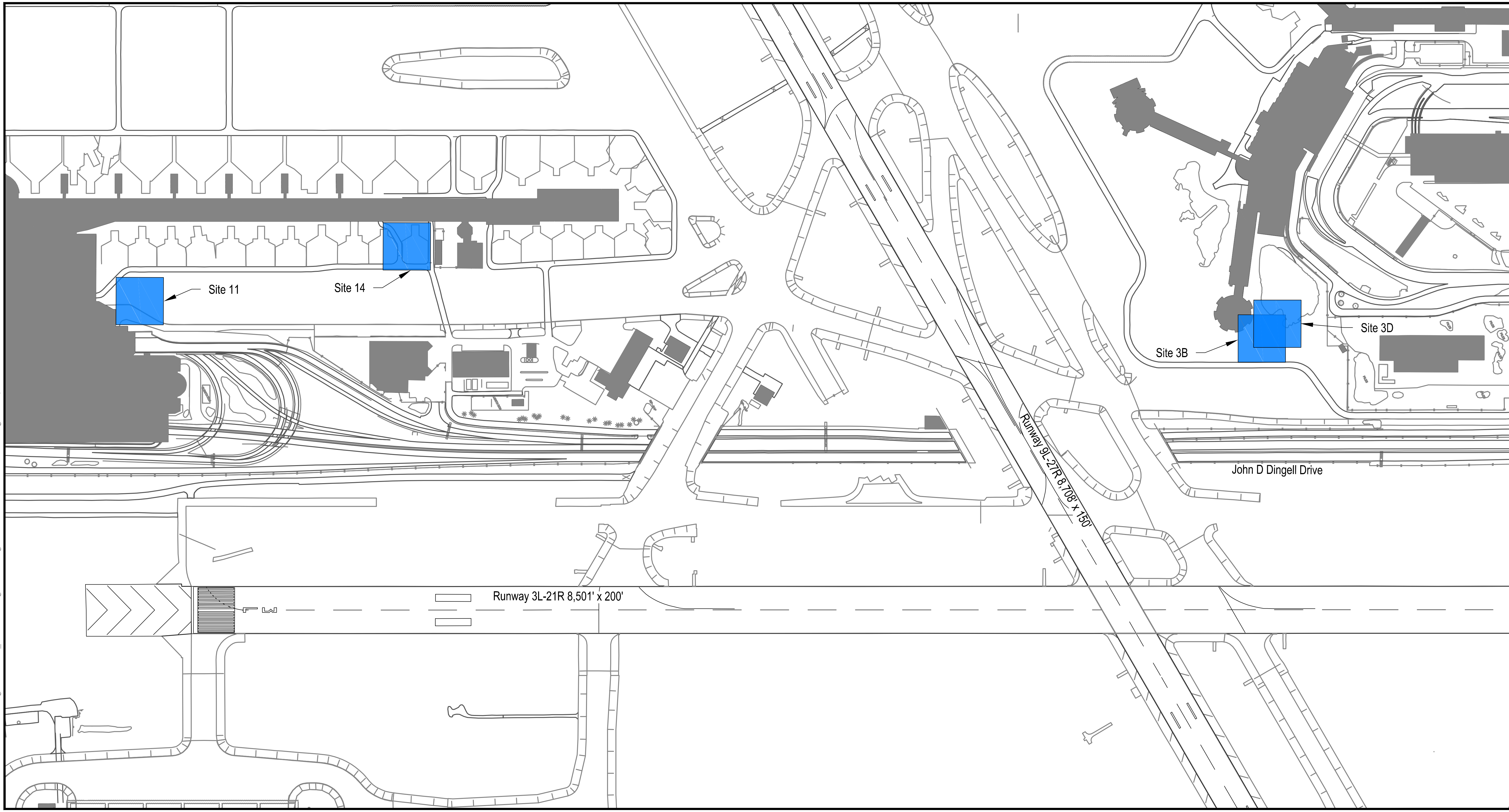
4.7.2.4 Aircraft Rescue and Fire Fighting Facility

There are three ARFF facilities within the airfield. The ARFFs are located in buildings 802, 509, and 737. Building 802 is located in the middle of the airfield adjacent to the FAA control tower, providing the primary coverage for the airfield. Building 509, located on the West Service drive, is a landside station that primarily serves the North Terminal and also provides some additional coverage for the airfield. Building 737 is the newest facility and is located on the outer perimeter next to the Fed-Ex building on the western edge of the Airport. This building was necessary due to the opening of runway 4L-22R and the McNamara Terminal. The proposed site was based on a study completed in 2002. The Airport utilizes international fire code 2015 and the campus is rated as class 3 in the ISO system. All fire alarms around the campus are directed to building 610.

4.7.2.5 FAA Facilities

The Airport's ATCT was constructed in 2002 and is located near the north end of the McNamara Terminal. The ATCT has a height of 250 feet and an observation height of 206 feet. The TRACON facility is located within the ATCT facility.

In 2012, the building was restored and underwent remediation for pervasive mold contamination. It was determined, however, that the ATCT will need to be replaced due to pervasive mold contamination of the building's shaft and substructure. Four preferred locations were determined (*ATCT Siting Report, Detroit Metropolitan Wayne County Airport Draft Report,* Airport Facilities Terminal Integration Laboratory). The location of these sites are identified on Figure 4-31.



LEGEND

Potential ATCT locations

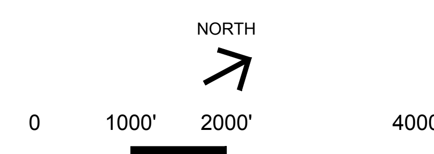


Figure 4-31
POTENTIAL AIRPORT TRAFFIC CONTROL TOWER (ATCT) LOCATIONS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
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Based on FAA analysis, Sites 11 and 14 were eliminated as candidate sites due to the determination that the operational and economic impacts of locating the new ATCT at these places would be immitigable. Site 3B, or a location site near Site 3B, was approved by the FAA. The placement of an ATCT at Site 3B would require the reconfiguration of the future expansion of the deicing pad to shift the taxilane object free area away from the proposed ATCT site. The implementation of an ATCT at this location would also require the relocation of aircraft parking and the relocation of portions of the operations roads serving facilities on the north side of the Airport.

4.7.2.6 Stormwater Detention

There are three stormwater detention ponds on the Airport:

- Stormwater Storage Pond 6 – located east of Middle Belt Road and south of Northline Road.
- Stormwater Storage Pond 3E (East) – located northeast of the threshold for Runway 21L.
- Stormwater Storage Pond 4 – located at the northwest corner of Northline and Middle Belt Roads.

The stormwater detention system has the capacity to detain approximately 515 million gallons of stormwater. In the event that the stormwater system is empty, it could contain a 4.5 inch runoff event. A series of stormwater pump stations exists throughout the Airport to control storm water runoff.

4.8 ENVIRONMENTAL CONDITIONS

Known environmental constraints pertaining to potential Airport development sites are summarized in the following sections. The following resource categories were identified as representing potential constraints to development at the Airport:

- **Department of Transportation Section 4(f) Lands** – Section 4(f) lands include publicly owned land of a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land of an historic site of national, State, or local significance.
- **Wetlands** –Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.
- **Floodplains** –Floodplains are lowland areas adjoining inland and coastal waters that are periodically inundated by flood waters.
- **Air Quality** – 40 CFR Part 93 requires that projects undertaken in a nonattainment or maintenance area must be shown to conform to the State Implementation Plan.

The physical location of known environmental constraints is depicted on Figure 4-32 Environmental Overview- Natural Environment, and Figure 4-33 Environmental Overview – Sites of Awareness. Figure 4-32 shows natural resource features such as wetlands, floodplains, and on-Airport locations of threatened and endangered species. Figure 4-33, while showing some off-Airport environmental features, identifies potential on-Airport waste sites, and the location of Building 348 (Executive Terminal) which is a historic site. The following sections discuss these features.

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LEGEND

- School
- Church
- FRS RCRA
- FRS NPDES
- Restricted Deed Site
- Open LUST Site
- Areas of Potential Concern
- SHPO Listed Historic Property
- Rail
- Airport Fence Line
- Stream/River/County Drain
- Impaired Stream/River
- Internal Airport Drain
- Waterbody
- DNR Land and Mineral Ownership
- Stormwater Detention Pond
- DEQ Conservation Easement
- City Boundary

NORTH

0 1,250' 2,500' 5,000'

Figure 4-32

ENVIRONMENTAL OVERVIEW - NATURAL ENVIRONMENT

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

Source: School, Park and Church were originally obtained from GNIS (Geographic Names Information System) maintained by US Board of Geographic Names and later modified by C&S based on Google Maps and survey data; FRS data was originally obtained from US EPA (Environmental Protection Agency) Clip and Ship application and later modified based on discussion with Airport Staff; Restricted Deed Site, Open LUST Site and Areas of Potential Concern are taken from DTW Environmental Management Plan, July 2014; SHPO property was marked based on discussion with Airport Staff; Airport Fence Line was taken from previous DTW Airport Layout Plan; Impaired stream data was downloaded from US EPA Geospatial data; Rail, road, water, streams and city boundary from Esri base map data; DEQ Conservation Easement and DNR Land and Mineral Ownership data downloaded from SEMCOG (South East Michigan Council of Governments) Online GIS database; Stormwater detention ponds are drawn as per discussion with Airport staff Service Layer Credits: Image courtesy of USGS State of Michigan Earthstar Geographics SIO © 2016 Microsoft Corporation | *FRS - Facility Registry System, RCRA - Resource Conservation and Recovery Act, NPDES - National Pollutant Discharge Elimination System

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LEGEND

- Surveyed Wetland 2014
- National Wetland Inventory Wetland*
- Airport Identified Wetland
- Location of Threated and Endangered Species
- Airport Property Line

Flood Hazard Zones

- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- 0.2% Annual Chance Flood Hazard

NORTH

0 1,250' 2,500' 5,000'

Figure 4-33

ENVIRONMENTAL OVERVIEW - SITES OF AWARENESS

Assessment of Existing Conditions
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

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*(a) Wetlands noted by the Airport staff as no longer existing (but indicated on National Wetlands Inventory maps) were removed.
*(b) Wetlands not noted on the National Wetlands Inventory map were added based on Airport staff indicating their presence.

Source: NWI Wetlands originally downloaded from USFWS (US Fish & Wildlife Service), Wetlands located on airport property are modified by C&S based on Airport staff indicating their presence; Endangered Species were originally extracted from survey data and then modified based on Airport staff indicating their presence; Flood Zones from FEMA NFHL Public Service Layer
Service Layer Credits: Image courtesy of USGS State of Michigan Earthstar Geographics SIO © 2016 Microsoft Corporation | *FRS - Facility Registry System, TRI - Toxic Resource Inventory, RCRA - Resource Conservation and Recovery Act, NPDES - National Pollutant Discharge Elimination System, Superfund Sites/CERCLIS - Comprehensive Environmental Response, Compensation and Liability Information System

4.8.1 DOT Section 4(f) Lands

No designated public parks, recreation areas, or wildlife or waterfowl refuges exist on Airport lands. Therefore, the consideration of DOT 4(f) lands focuses on lands that are on or potentially eligible for listing on the National Register of Historic Places (NRHP). Based on a search of the National Park Service web site, no sites presently on the NRHP are located at the Airport or in the immediate vicinity. Therefore, sites that may be eligible for the register were identified based on past evaluations.

The Authority commissioned a Cultural Resources Management Study (CRMS) in 2009 (updated in 2013) recognizing that a number of facilities at the Airport had been identified by the State Historic Preservation Office (SHPO) as of sufficient age to be considered under the National Historic Preservation Act. The CRMS identified 15 structures and portions of the airfield system as 50 years of age or older, and two buildings were considered eligible for listing in the NRHP.*

Building 348, identified on Figure 4-33, also known as the Executive Terminal (built in 1938), is recognized for its architectural design and its association with the beginnings of air passenger service in Detroit. Building 348 is considered eligible for listing in the NRHP due to its architectural significance and the development of aviation in Michigan. Any projects that would require a use of the above facilities (or any other resources that are determined to be eligible for the NHRP), would require compliance with DOT Section 4(f) in addition to completion of the Section 106 consultation procedures under the National Historic Preservation Act. Projects that involve effects to DOT 4(f) resources require preparation of a DOT 4(f) Statement which is usually prepared in consultation with the NEPA document prepared for the project.

4.8.2 Wetlands

As shown on Figure 4-32, there are a number of wetlands on Airport property consisting of ponds, emergent wetlands, and forested/shrub. Surveyed wetlands are generally located west of Runway 4L-22R and between Runways 4L-22R and 4R-22L (on the southern portion of the open space). In addition, the ponds of the Airport are noted as open water wetlands.

A Clean Water Act Section 404 permit would be required for any development that results in fills to waters of the U.S. that are considered wetlands. Under Section 404, no discharge of dredged or fill material can be permitted if a practicable alternative exists that avoids or minimizes wetland impacts. Therefore, when an airport sponsor applies for a permit, the sponsor must demonstrate (1) steps taken to avoid wetland impacts where practicable, (2) steps taken to minimize potential impacts to wetlands, and (3) compensation for any remaining, unavoidable impacts through activities to restore or create wetlands.

4.8.3 Floodplains

Figure 4-32 shows floodplains are located south of Eureka Road and north of I-94. Similar to the discussion of wetlands, the Master Plan Update should identify alternatives that do not involve encroachment into floodplains.

All areas where permanent infrastructure would be built, and locations where temporary construction-related activity might occur, must be considered for direct or indirect construction-related impacts. If the only practicable alternative requires siting in the base floodplain, a floodplain encroachment would occur and further environmental analysis is needed during the NEPA process. Therefore, alternatives that would avoid the floodplain should be considered. The FAA may not select or approve a preferred alternative involving a significant floodplain encroachment, unless the responsible FAA official can make a written

*SHPO determined in 2003 that Building 278 (Hertz Storage Facility, 1929) was eligible for listing on the NRHP. The building was subsequently demolished after FAA completed a Section 106 consultation subject to a Memorandum of Agreement that contained mitigation measures.

finding that (1) there is no practicable alternative to placing a project in the floodplain and that all measures to minimize harm will be included in a project, (2) the proposed action must be located in the floodplain, including a discussion of the alternative(s) and why they were not practicable, (3)and the action conforms to applicable state and/or local floodplain protection standards.

4.8.4 Air Quality

The Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) for air pollutants that are considered harmful to the health of the public and to the environment. Primary standards provide protection for the public's health and secondary standards protection the public's welfare (e.g., damage to buildings, vegetation, and visibility). There are currently NAAQS for six air pollutants that are referred to as the "criteria" air pollutants. The pollutants are:

- Ozone (O_3)
- Nitrogen dioxide (NO_2)
- Carbon monoxide (CO)
- Particulate matter (PM) – Less than or equal to 10 micrometers (coarse particulate matter or PM_{10}) and less than or equal to 2.5 micrometers (fine particulate matter or $PM_{2.5}$)
- Sulfur dioxide (SO_2)
- Lead (Pb)

In accordance with the CAA, all areas within the U.S. are designated with respect to the NAAQS as attainment, non-attainment, maintenance, or unclassifiable. An area with air quality better than the NAAQS is designated attainment; an area with historical air quality conditions worse than the NAAQS is designated non-attainment. Maintenance areas are non-attainment areas that have been re-designated to attainment status.

Wayne County, Michigan has been designated by the USEPA as a non-attainment area for sulfur dioxide, and maintenance for carbon monoxide. In the past, the area was designated as non-attainment or maintenance for ozone and particulate matter, but the rules/standards that resulted in those designations have since been revoked and therefore the region is now in attainment. However, a new ozone standard was enacted by the U.S. EPA in October 2015. When enacting a new standard, the U.S. EPA has a period of time to then designate areas as attainment or nonattainment. Areas will not be designated for another year (late 2017). Based on the new standard and preliminary analysis, it is expected that the Detroit metropolitan region could become nonattainment with the new ozone standard resulting in the development of a new State Implementation Plan (SIP).

The conformity provisions of the CAA, require that before a federal agency can approve a federal action, the agency must first show that actions occurring in a non-attainment or maintenance area conform with the applicable SIP. A SIP is the State's plan for how it will attain and maintain the NAAQS. Federal approvals associated with Master Plan Update recommendations would require an air quality evaluation to show if emissions are sufficient to warrant a Conformity Determination and that the emissions conform to the SIP in place at the time of the approval.

4.8.5 Other Issues

If Master Plan Update recommendations induce activity or alter the use of the runway system, aircraft noise exposure contours would be needed to identify off-airport noise and land use effects. The Authority completed a Part 150 Noise Compatibility Planning Study in 2009 for which noise exposure contours were prepared.

According to the Michigan Natural Features Inventory, 140 species of plants, fish and wildlife in Wayne County are listed by at the federal and state level as endangered, threatened, candidate or of special concern. The Airport and nearby areas support two state-threatened plant species: three-awned grass (*Aristida longespica*) and short-fruited rush (*Juncus brachycarpus*). A Protected Species Area is managed on-Airport for these plants, which is generally located under the approach to Runway 4R north of Eureka Road, as shown on Figure 4-32. A second area is located near the end of Runway 27L near the intersection of Middlebelt and Eureka Roads.

Given the age and nature of operations at the Airport, there have been spills of jet fuel and other hazardous materials on-site. Figure 4-33 shows the know location of contamination sites, largely located in the northern part of the Airport in the maintenance areas. Projects that would disturb hazardous material would require development of a clean-up plan and coordination with appropriate agencies.

Chapter 5
FACILITY REQUIREMENTS

This chapter summarizes facilities, land areas, and policies required to accommodate aviation demand throughout the 20-year forecast period. Facility requirements were developed for the airfield, passenger terminal complex, ground access, air cargo, general aviation, and airline and Airport support facilities, including the Airport maintenance complex, based on assessments of existing capacity and future demand for major aviation-related facilities. The chapter is organized as follows:

- Activity Data and Requirements Summary
- Airfield and Airspace
- Passenger Terminal Complex
- Ground Transportation and Parking
- Air Cargo and General Aviation
- Airport Maintenance Complex

5.1 ACTIVITY DATA AND REQUIREMENTS SUMMARY

The following sections summarize planning activity levels identified to handle future facility demands, development of future flight schedules that establishes gate requirements, which affect facility sizing, and summary results of the Airport facility requirements.

5.1.1 Planning Activity Levels

Recognizing uncertainties associated with long-range aviation demand forecasting, three planning activity levels (PALs) were identified to represent future levels of activity at which key airside and landside improvements would be necessary. Because activity levels could deviate from the forecasts for any number of reasons, the use of PAL “triggers” allows for facilities planning that is realistically tied to future activity levels as they occur, rather than arbitrary milestone years. For this Master Plan Update, PALs were chosen to coincide with the growth forecast to ensure facilities are available just prior to when they would be needed. PAL 1, PAL 2, and PAL 3 correspond to aviation activity for 2020, 2025, and 2035, respectively. Aviation activity associated with each PAL is summarized in Table 5-1.

5.1.2 Future Flight Schedules

Detailed aircraft flight schedules provide a planning-level synopsis of aviation activity (peak periods, time-of-day, departures and arrivals, fleet mix, etc.) that is used to support analytical and simulation modeling. Flight schedules were developed for the Master Plan Update in order to generate some of the facility requirements contained herein. A detailed flight schedule representing Airport activity in the base year (2015) was developed using existing patterns of aviation activity and operational assumptions developed for the Master Plan Update. Future flight schedules for each PAL were developed from the base year flight schedule by applying growth rate factors based on forecast assumptions.

Passenger activity included in the flight schedules was developed based on projected average day peak month (ADPM) passenger activity, which has historically occurred during the month of July. Future flight schedules also include average annual day air cargo and general aviation activity. Simulation modeling used to develop airfield requirements used the overall “design day” flight schedule, which includes ADPM activity for both passenger airline and air cargo market segments. Requirements for the passenger terminal used only the passenger airline portions of the “design day” schedules. Design day activity for each PAL is summarized in Appendix F.

Table 5-1
SUMMARY OF FORECAST AVIATION DEMAND
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Historical		Baseline forecast		
	2014	2015	PAL 1 (2020)	PAL 2 (2025)	PAL 3 (2035)
Enplaned passengers					
Origin-destination	8,444,564	8,862,821	10,005,200	11,015,900	13,127,200
Connecting	7,769,170	7,818,434	8,013,800	8,214,200	8,524,700
Total	16,213,734	16,681,255	18,019,000	19,230,100	21,651,900
Cargo tonnage (*a*)					
All-cargo airline	101,714	100,953	106,200	111,600	123,400
Passenger airlines	100,317	92,498	109,000	122,000	150,000
Total	202,032	193,451	215,200	233,600	273,400
Aircraft operations					
Passenger (*b*)	386,239	373,431	387,420	402,870	431,280
General aviation	6,264	5,843	5,800	5,800	5,800
Military	132	102	100	100	100
Total	392,635	379,376	393,320	408,770	437,180

(a) Includes air freight and mail, in metric tons
(b) Includes air cargo aircraft operations

Sources: Historical—Wayne County Airport Authority records and U.S. Department of Transportation.
Forecast—LeighFisher, March 2016.

5.1.3 Summary of Facility Requirements

A summary of Airport facility requirements for baseline (2015) and future PALs organized according to functional areas are provided in Table 5-2. As shown, many Airport facilities provide sufficient capacity to accommodate demand forecast throughout the planning period. However, a number of facilities will need to be modified or expanded to accommodate future activity; improve Airport operational capabilities or levels of service; and/or satisfy design standards.

Notable requirements over the course of the forecast period include:

- **Airfield** – The existing airfield layout will provide sufficient capacity to accommodate forecast aviation activity throughout the planning period. Airfield simulation models indicate that targeted taxiway improvements have the potential to address FAA criteria and improve operational efficiency. Deicing pads need to be modified to meet new FAA dimensional standards and new pads or modifications of pads to handle additional widebody aircraft are also required. Existing air traffic control facilities, NAVAIDS, and visual aids are sufficient to support airfield and airspace operations through the end of the planning period.

Table 5-2
SUMMARY OF FACILITY REQUIREMENTS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

		Estimated requirement *(a)*			
	Existing	Baseline (2015)	PAL 1 (2020)	PAL 2 (2025)	PAL 3 (2035)
AIRFIELD					
Design Aircraft	B-747-400	B-747-400	A-350_1000	A-350_1000	A-350_1000
Airfield Design Group	D-V	D-V	D-V	D-V	D-V
Taxiway Design Group	5	5	6	6	6
Runway length (feet)					
Primary departure runway	12,000/8,500	12,000/8,500	12,000/8,500	12,000/8,500	12,000/8,500
Other runways	10,000	10,000	10,000	10,000	10,000
Instrument approach capability					
North flow (calm winds)	CAT IIIb	CAT IIIb	CAT IIIb	CAT IIIb	CAT IIIb
South	CAT I-II	CAT I-II	CAT I-II	CAT I-II	CAT I-II
West	CAT I	CAT I	CAT I	CAT I	CAT I
East	Visual	Visual	Visual	Visual	Visual
PASSENGER TERMINAL: McNAMARA					
Gates/aircraft parking	120	86	87	92	103
Ticketing and check-in					
Agent counters (positions)	84	7	7	7	7
Self-service kiosks (units)	49	23	20	15	10
Bag drops (units)		14	23	35	47
Check-in area (sq ft)	28,100	11,800	13,300	14,100	15,400
Passenger security screening					
Checkpoints (lanes)	11	12	12	12	13
Checkpoint area (sq ft)	18,500	21,700	22,100	22,900	24,400
PASSENGER TERMINAL: NORTH TERMINAL					
Gates/aircraft parking	29	26	27	28	29
Ticketing and check-in					
Agent counters (positions)	86	12	12	12	12
Self-service kiosks (units)	24	42	32	25	16
Bag drops (units)		25	35	53	71
Check-in area (sq ft)	36,500	18,700	19,900	21,300	23,400
Passenger security screening					
Checkpoints (lanes)	10	14	14	16	18
Checkpoint area (sq ft)	18,200	27,000	27,400	30,900	33,900

Table 5-2 *(continued)*
SUMMARY OF FACILITY REQUIREMENTS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

		Estimated requirement *(a)*			
	Existing	Baseline (2015)	PAL 1 (2020)	PAL 2 (2025)	PAL 3 (2035)
GROUND TRANSPORTATION					
Parking					
Short-term (stalls)	926	768	810	845	939
Long-term (stalls)	17,061	17,355	18,558	20,575	21,869
Employee (stalls)	6,112	4,948	4,345	5,705	6,424
Departures curbside frontage (ln ft)					
McNamara Terminal	760	775	800	800	875
North Terminal	740	500	525	600	625
Arrival curbside frontage (ln ft)					
Private vehicle—frontage (ln ft)					
McNamara Terminal (Domestic)	950	725	775	800	850
McNamara Terminal (International)	240	850	925	950	1,000
North Terminal	830	750	775	875	925
Commercial vehicle—frontage (ln ft)					
McNamara Terminal	925	1,025	1,025	1,135	1,135
North Terminal	850 (+9 spaces)	545 (+7 spaces)	545 (+7 spaces)	270 (+7 spaces)	270 (+7 spaces)
Rental car ready/return (stalls)	3,275	4,935	5,251	5,705	6,254
Rental car land area (acres)	64.9	81.5	86.7	94.2	103.3
AIR CARGO					
Air cargo hangar (sq ft)					
All-cargo	117,000		100,700	105,800	117,000
Belly-cargo	110,000		124,700	139,600	171,600
Aircraft parking apron (sq ft)					
All-cargo	586,000		503,900	529,500	585,500

Note: Some requirements rounded to the nearest hundred.

- **Airspace** – The Airport is currently well served by existing airspace, which is not significantly impacted by the presence of other major airports in the region. The airspace is currently being redesigned as part of the Detroit-Cleveland Metroplex project. The purpose of the Metroplex project is to design the airspace in a way that takes advantage of new NextGen Air Traffic Management (ATM) capabilities. The new NextGen ATM provides the ability to reduce flight distances and minimize in-efficient altitude restrictions all while maintaining or increasing airspace capacity. Airfield improvements that can take advantage of airspace efficiencies of NextGen will be considered in developing airfield alternatives.

- **Passenger Terminal** – The existing passenger terminals are adequate to serve the projected needs of the Airport throughout the planning period. Future requirements are focused on targeted improvements to specific functional elements that are likely to experience congestion, including: expanding aircraft gates and passenger holdrooms; improving passenger security screening facilities; and repurposing the existing check-in area for other demand driven functions to better meet existing and future peak-period passenger demands. Future terminal projects should also consider additional FIS accessible gates to accommodate widebody aircraft.

- **Ground Transportation** – Several elements of the ground transportation systems and facilities are currently at or near capacity and will need to be expanded and/or relocated during the planning period. Most notably, the existing rental car facilities require significant expansion. Two potential zones are analyzed extensively and will be carried forward into alternatives development. Additionally, public parking has reached capacity during peak time periods, so the alternatives analysis will reflect expanded parking facilities and demand management techniques. Similarly, some areas of the curbside roadways and Ground Transportation Centers (GTCs) require additional space by the end of the planning period, so a combination of facility expansion and demand management will be employed during alternatives analysis.

- **Air Cargo** – Additional processing/warehouse space and aircraft parking apron will be required during the planning period. In addition, modification to facilities or access roadways may be identified during the alternatives analyses phase of the Master Plan.

- **General Aviation** – Forecast general aviation demand will not necessitate an increase in facilities or land area dedicated to general aviation.

- **Airport Maintenance Complex** – A conditions assessment and analysis of the Airport's existing Maintenance Complex identified areas of the campus that will require future expansion, upgrade, or replacement to meet future Airport maintenance needs. The analysis indicates that several of the existing maintenance facility components will need to be expanded or replaced to ensure that the facilities that support Airport maintenance operations are adequate throughout the 20-year program period.

Additional facility requirements and more robust discussions of assumptions and findings are provided in the ensuing sections.

5.2 AIRFIELD AND AIRSPACE

The assessment of airfield and airspace facility requirements was based on the following primary objectives:

- Review findings of the prior master plan and assess the need for additional capacity / runways.
- Identify potential changes to the airfield layout or new / modified airfield based on the following: changes in the future fleet mix; meeting airport design standards or eliminate existing modifications to design standards (MOS); and changes based on new FAA design standards and policies.
- Identify potential changes or needs related to the Airport's existing deicing facilities and operations (using fast-time simulation of the airfield, where appropriate).
- Address known conflicts with airfield safety zones and Federal Aviation Regulations (FAR) Part 77 obstacle clearance surfaces.

The FAA's Airport and Airspace Delay Simulation Model (SIMMOD)—a fast-time airfield and airspace simulation model—was used to assess the performance of the existing and future airfield. The actual software used for this project was SIMMOD Pro, which is an advanced version of SIMMOD created by ATAC Corporation. Simulation modeling was undertaken in coordination with Authority staff, FAA Air Traffic Organization (i.e., Detroit Tower and TRACON), Airport users/tenants, as well as expert judgments. Although SIMMOD was used to facilitate identification of airfield requirements, the model will primarily be used in the evaluation of airfield alternatives.

5.2.1 Annual Service Volume

The Annual Service Volume (ASV) is defined as a reasonable estimate of the annual capacity of an airfield. As the level of operations approaches ASV, additional increases in air traffic movements result in disproportionate increases in aircraft delays. However, ASV does not represent a "hard upper limit" on the number of operations that can be accommodated, and it is commonly exceeded at many airports throughout the world. ASV takes into account differences in runway use, weather conditions, and mix of aircraft over a one-year period. ASV is calculated by the following formula provided in FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*:

$$ASV = Cw \times D \times H$$

Where:

Cw is the weighted average hourly capacity of the airfield
D is the ratio of annual demand to average daily demand in the peak month
H is the ratio of average daily demand to average peak hour demand in the peak month

For this assessment, "H" and "D" factors were derived from actual data from 2012 on peak hour aircraft operations, ADPM aircraft operations, and annual aircraft operations.

The ASV for the airfield was calculated to be approximately 680,000 annual aircraft operations. The ASV is presented graphically on Figure 5-1 against existing and forecast total annual aircraft operations. In general, additional airfield capacity should be planned when annual operations reach 80% of the airfield's ASV; and should be in place before ASV is reached.

Figure 5-1
ANNUAL SERVICE VOLUME
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Source: HNTB, May 2016.

As presented on Figure 5-1, the forecast total annual aircraft operations in the 20 year planning horizon do not reach 80% of the calculated ASV, and therefore no additional runways will be needed or considered in this Master Plan Update.

5.2.2 Existing and Future Critical Aircraft

The FAA defines the critical aircraft for an airport as the aircraft representing the combination of the most demanding Aircraft Approach Category (AAC) and Aircraft Design Group (ADG) with greater than 500 annual operations at the airport. The Airport's existing critical aircraft is the Boeing 747-400, with an Airport Reference Code (ARC) designation D-V and Taxiway Design Group (TDG) 5, and a maximum takeoff weight of 875,000 lbs. Aviation activity forecasts project that by 2020, the future critical aircraft will be the Airbus A350-1000, with ARC designation D-V, TDG 6, and a maximum takeoff weight of 681,000 lbs. Requirements associated with the existing and future critical aircraft are presented in Table 5-3.

While aviation activity forecasts do not project Boeing 777-300ER or Boeing 777-9X aircraft in the future fleet mix, it is important to evaluate whether these aircraft can safely operate at the Airport in the event of changes in forecast assumptions. As presented in Table 5-3, both of these aircraft have design characteristics similar to the A350-1000.

Table 5-3
REQUIREMENTS ASSOCIATED WITH EXISTING AND FUTURE CRITICAL AIRCRAFT
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

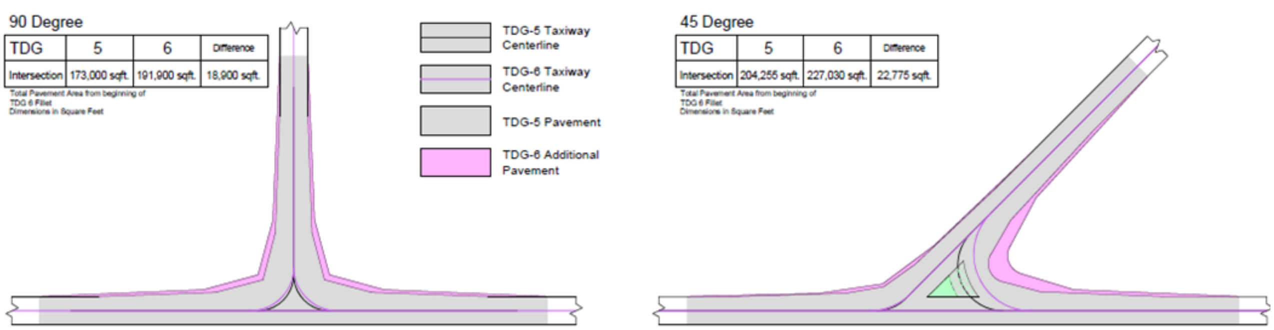
	Existing B747-400	Future A350-1000 *(b)*	Future B777-300ER	Future B777-9X *(b)*
Length (ft.)	231.8	242.4	242.3	251.8
Wingspan (ft.)	213.0	212.4	212.6	212.7 *(a)*
Tail Height (ft.)	63.7	56.0	60.9	64.6
Maximum Take-off Weight (lbs.)	875,000	681,000	775,000	775,000
Approach speed (knots)	157	150	149	149
Aircraft Approach Category	D	D	D	D
Airplane Design Group	V	V	V	V
Taxiway Design Group	5	6	6	6

(a) Runway and airspace wingspan is 235.5 ft.
(b) Preliminary information.

Source: Airplane Design Manuals, AC 150/5300-13A, Change 1 and HNTB.

With a change in the future critical aircraft, taxiway improvements that currently do not meet TDG 6 standards must be modified. Most taxiway intersections at the Airport have been designed to meet TDG 5 standards. As illustrated on Figure 5-2 below, a standard 90 degree intersection for TDG 6 requires approximately 18,900 square feet of additional pavement when compared to a TDG 5 intersection. The main cause for the increase in pavement area is the larger fillets needed to maintain the taxiway edge safety margin for TDG 6. The alternatives analysis will consider potential improvements to taxiway intersections to meet TDG 6 standards.

Figure 5-2
COMPARISON OF TAXIWAY DESIGN GROUP 5 AND 6
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



5.2.3 FAA Design Standards

The following discusses airfield requirements related to existing and new FAA design standards and policies.

5.2.3.1 Modifications of Design Standards

There are currently nine FAA-approved Modifications of Design Standards (MOS) at the Airport that concern airfield geometry. Six of the MOS are provisions to enable the Boeing 747-8 to operate at the Airport,* and include the following:

- Runway 4R-22L to parallel Taxiway Y separation
- Taxiway Y edge safety margin
- Taxiway Y shoulder width
- Taxiway Y full strength pavement width
- Taxiway Y centerline to parallel Taxiway K centerline and Taxiway Object Free Area (TOFA) clearance
- Runway 4L-22R runway width

The remaining three MOS include: Taxiway Q visual screen for Runway 4R-22L, Runway 9L holdbar signage, and Runway 4R holdbar signage. To the extent practicable, these three approved MOS will be reviewed in the Alternatives analysis to determine if a physical improvement is possible so that an MOS is no longer needed.

5.2.3.2 Deviations from Design Standards

There are 11 deviations from airport design standards that exist on the airfield based on the existing critical aircraft (Boeing 747-400). These 11 deviations are presented on Figure 5-3. The future critical aircraft is the Airbus 350-1000. It has the same Aircraft Approach Category (AAC) D and Airplane Design Group (ADG) V as the B-747-400; however, the Airbus A350-1000 is a TDG 6 aircraft which, as presented in Section 2.2, has increased taxiway fillet requirements over the Boeing 747-400. The 11 existing deviations all apply to the future critical aircraft as well.

To the extent practicable, the alternatives analysis will review potential improvements to rectify these design deviations. Options include physical geometry changes, operational restrictions (e.g., reduction in ADG/TDG movements prohibited in certain conditions, or operations escort), and preparing additional MOS for FAA approval. The implications of proposed improvements will be considered to ensure no adverse impacts to airfield efficiency and capacity.

As presented on Figure 5-3 there are three runway ends – Runways 9L, 27L, and 22R – that are not in compliance with Runway Object Free Area (ROFA) design standards. To the extent practicable, the alternatives analysis should identify potential geometrical improvements to meet the required standard. The sub-standard conditions for these three ROFAs are limited to vehicle service road alignments that should be able to be relocated to an alignment outside of the ROFA. If meeting the standard is not feasible, an MOS should be filed with the FAA to seek a formal determination for the non-standard condition.

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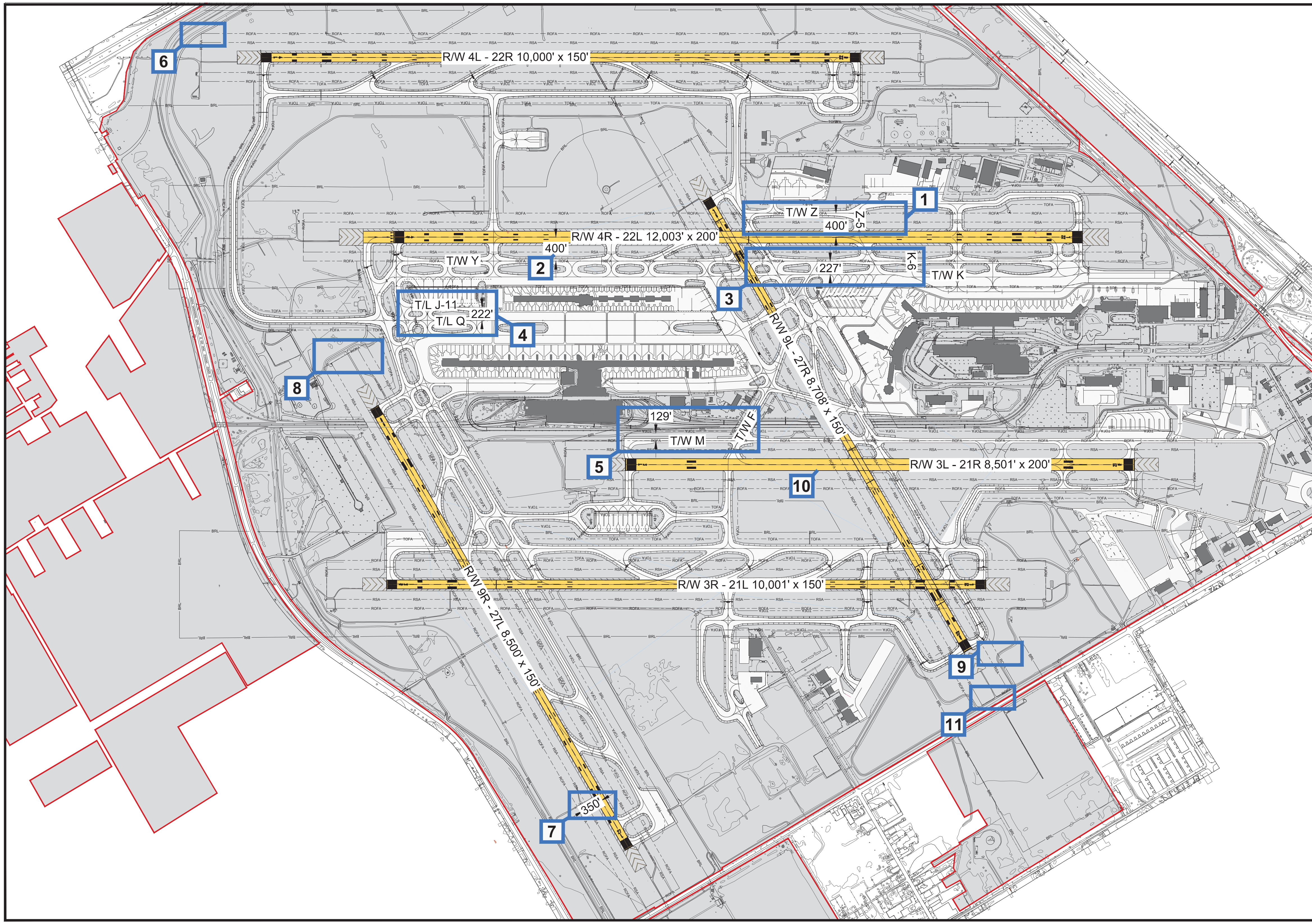
*WCAA has an FAA-approved plan to operate the Boeing 747-8 (ADG VI) at the Airport, which requires the six MOS. However, aviation activity forecasts do not include any Boeing 747-8 in the future fleet mix. Should an occasional Boeing 747-8 operate at the Airport, a plan is in place to accommodate these operations, and physical upgrades to the airfield geometry are not needed.



GEOMETRY DEVIATION FROM DESIGN STANDARD DESCRIPTION

1. The Runway 4R-22L centerline and parallel Taxiway Z centerline are separated by 400 feet south of Taxiway Z5. This does not meet standards when weather conditions fall below CAT I conditions, which require 500 feet of separation.
2. The Runway 4R-22L centerline and parallel Taxiway Y centerline are separated by 400 feet. This does not meet standards when weather conditions fall below CAT I conditions, which require 500 feet of separation.
3. The Taxiway Y centerline and Taxiway K centerline between Runway 9L-27R and Taxiway K6 are separated by 227 feet. This does not meet ADG-V taxiway to taxiway separation standards of 267 feet as required.
4. The Taxilane J11 centerline and Taxilane Q centerline are separated by 222 feet. This does not meet the required taxilane to taxilane separation standards of 245 feet.
5. The vehicle service road (VSR) penetrates the Taxiway M Taxiway Object Free Area (TOFA) south of Taxiway F by as much as 31 feet. TOFAs are required to be clear of service roads.
6. The VSR penetrates the Runway 22R Runway Object Free Area (ROFA) beyond the stop end of the runway by 12 feet, reducing the available ROFA beyond the stop end of the runway to 988 feet. This does not meet ROFA clearance standards.
7. The Runway 9R-27L centerline and Runway 27L glideslope antenna are separated by 350 feet. This does not meet standards for runway centerline to glideslope separation.
8. The VSR penetrates the Runway 27L ROFA beyond the stop end of the runway by 74 feet, reducing the available ROFA beyond the stop end of the runway to 926 feet. This does not meet ROFA clearance standards.
9. The VSR penetrates the Runway 9L ROFA beyond the stop end of the runway by 608 feet, reducing the available ROFA beyond the stop end of the runway to 392 feet. This does not meet ROFA clearance standards.
10. Runway 3L-21R does not currently have paved shoulders. 35 foot wide shoulders are required for Runway 3L-21R.
11. The RSA beyond the stop end of Runway 9L is limited by 90 feet. Declared distances are currently applied to the runway to mitigate this non-standard condition.

LEGEND

	RUNWAY PAVEMENT	ROFA	RUNWAY OBJECT FREE AREA	R/W	RUNWAY
	TAXIWAY / APRON PAVEMENT	RSA	RUNWAY SAFETY AREA	T/W	TAXIWAY
	OTHER PAVEMENT IN USE	TOFA	TAXIWAY OBJECT FREE AREA		GEOMETRY DEVIATION FROM DESIGN STANDARD
	BUILDING - EXISTING - On Airport		FENCE		AIRPORT PROPERTY LINE

North

0 900' 1800' 3600'

Figure 5-3

GEOMETRY DEVIATIONS FROM DESIGN STANDARDS

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Source: HNTB, March 2016

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5.2.3.3 Runway Incursion and Surface Incident History

Historical runway incursion and surface incident data was reviewed for the Airport dating back to 2000. Sources included the FAA's Airport Incidents Database System (AIDS) and NASA's self-reported Aviation Safety Reporting System (ASRS). A total of 47 and 308 incidents were identified relating directly to the airfield from the AIDS and ASRS databases, respectively. This review and data collection identified trends and also indicated whether upstream or downstream factors were contributing to the number of incursions and surface incidents. The locations of these incidents are identified on Figure 5-4. A review of these incidents (combined with the Hot Spot and RIM analysis described below) will (1) help identify whether geometry, marking/lighting/signage, operational factors, and/or human factors are contributing elements; and (2) facilitate the prioritization of the investment in airfield improvements. Alternatives will be proposed to reduce the potential for runway incursions and surface incidents at each of these locations.

5.2.3.4 Hot Spots

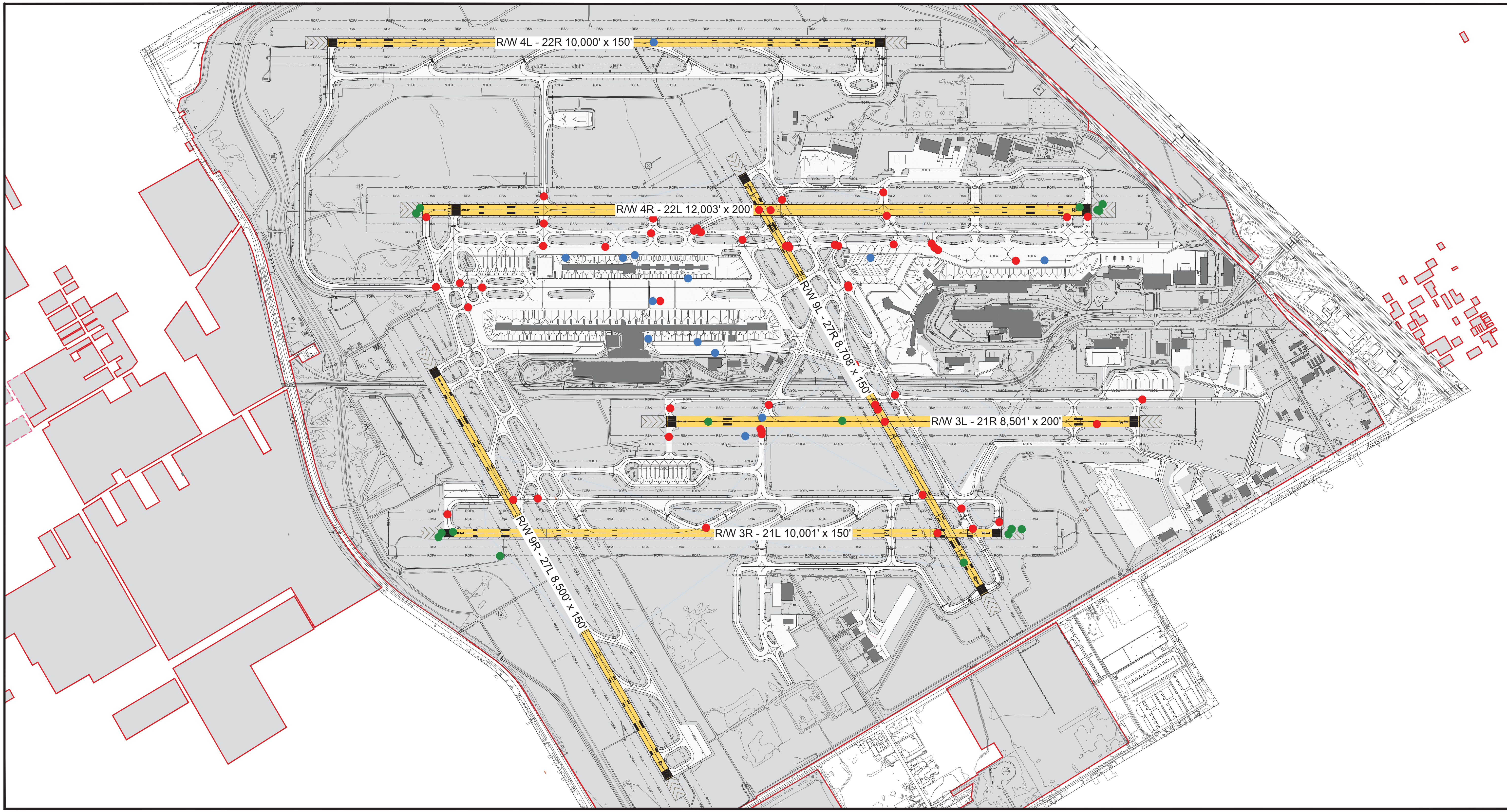
The FAA defines a Hot Spot as a location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and surface vehicle drivers is necessary. Hot Spots are defined from Runway Safety Action Team (RSAT) meetings and from analyzing incursion/incident history.

Existing airfield Hot Spots are identified on Figure 5-5. To the extent feasible, Hot Spots should be mitigated to reduce the risk of incursion or other surface incident. Potential mitigation strategies can include physical geometry changes, visual cue changes (including marking, lighting, and signage), operational changes, and combinations of all three. The RSAT determines whether a Hot Spot is deemed mitigated and can be removed from the FAA's listing.

5.2.3.5 Runway Incursion Mitigation

FAA's Advisory Circular (AC) 150/5300-13A consolidates a variety of recent research findings related to airfield safety. Previously airfield safety enhancement bulletins had been published in FAA orders and engineering briefs. The research correlates existing design geometries with incursion history as well as the future potential for an incursion to take place. The FAA found that there are specific airfield geometries that can result in incursions and have broadly identified them as follows:

- Runways – Complex or too many runway intersections; runways beginning near the intersection of a crossing runway; misaligned runway arrival thresholds (pilots can misidentify a runway as a taxiway or vise-versa);
- "High energy intersections" – Aircraft should not have runway crossing points in the middle 1/3 of a runway to provide enhanced pilot situational awareness
- Taxiways – Complex taxiway intersections with greater than 2 intersecting paths; extra-wide taxiway pavements impacting signage visibility; taxiways that lead directly from a ramp to a runway; direct runway crossings from one runway to another; entrance taxiways to runways (need to visually delineate both the taxiway and runway for approaching aircraft)
- Runway/taxiway and taxiway/taxiway intersections – Right angles provide the best left and right visibility for a pilot at an intersection
- Dual use pavements – Maintaining a single/dedicated use of airport pavements reduces confusion and enhances pilot situational awareness



LEGEND

RUNWAY PAVEMENT

TAXIWAY / APRON PAVEMENT

OTHER PAVEMENT IN USE

BUILDING - EXISTING - On Airport

ROFA — RUNWAY OBJECT FREE AREA

RSA — RUNWAY SAFETY AREA

TOFA — TAXIWAY OBJECT FREE AREA

FENCE

R/W — RUNWAY

T/W — TAXIWAY

AIRPORT PROPERTY LINE

AVIATION SAFETY REPORTING SYSTEM REPORT NUMBER ACCIDENT/INCIDENT LOCATION MARKING

AVIATION SAFETY REPORTING SYSTEM REPORT NUMBER ACCIDENT/INCIDENT LOCATION MARKING (DEPARTURE & APPROACH RELATED)

ACCIDENT & INCIDENT DATA SYSTEM ACCIDENT/INCIDENT LOCATION MARKING

North

0 1700' 3600'

Source: AVIATION SAFETY REPORTING SYSTEM DATABASE, FAA ACCIDENT & INCIDENT DATA SYSTEM (AIDS), HNTB, March 2016

Figure 5-4

ACCIDENT/INCIDENT LOCATION MARKING

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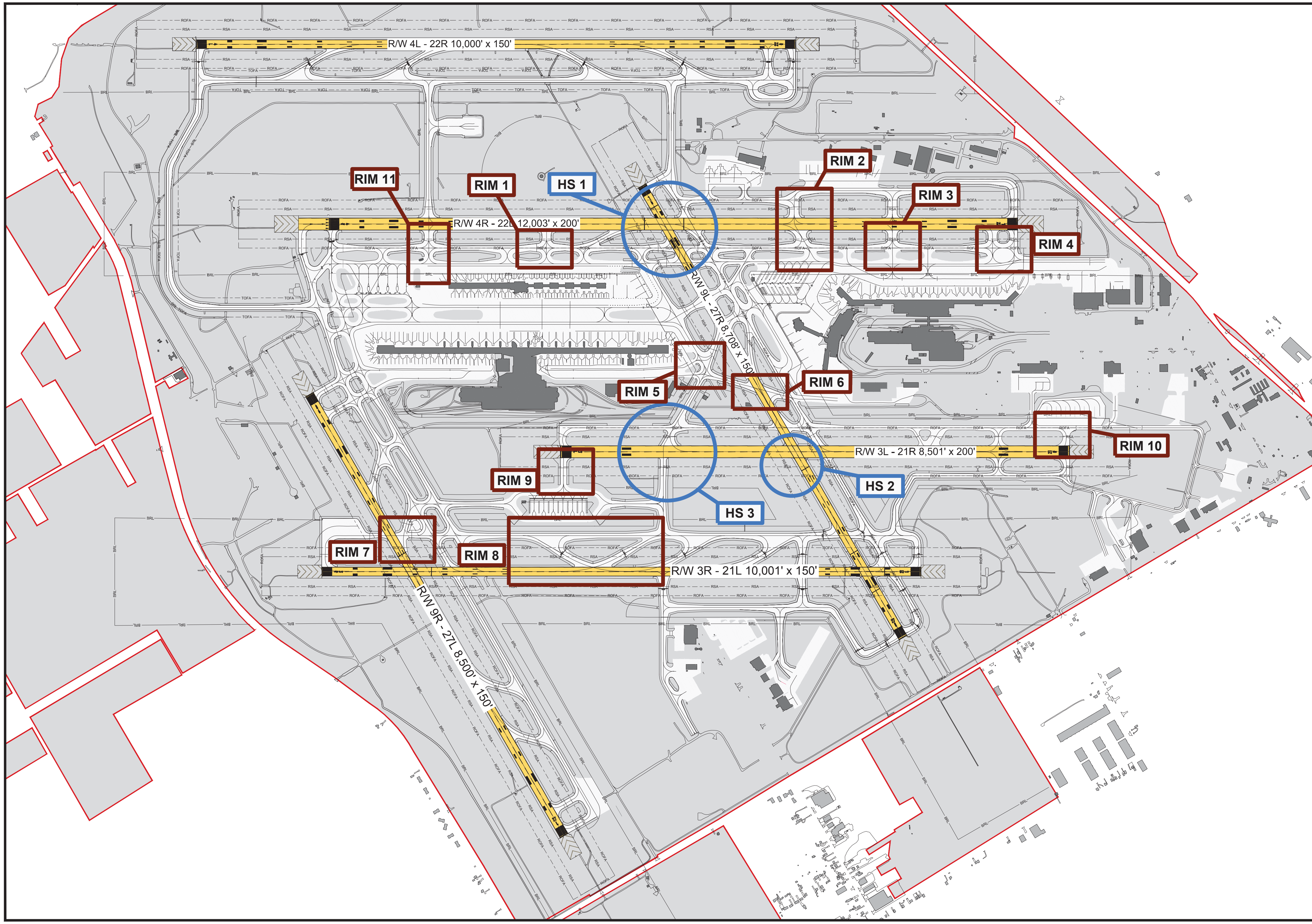

RUNWAY INCURSION MITIGATION (RIM) AREAS DESCRIPTION

RUNWAY INCURSION MITIGATION (RIM):

1. Taxiways K3 and Y3 lead directly from the air carrier apron directly to a runway, which is in conflict with recommended RIM criteria.
2. The Runway 4R-22L crossing at Taxiways Z5, Y5, and K5 is at an acute angle, which can limit the visibility of the runway for the crossing aircraft and increases distance and travel time of the runway crossing. Additionally the crossing is within the high-energy middle third portion of the runway. These elements conflict with recommended RIM criteria.
3. Taxiways K7 and Y7 lead directly from the air carrier apron directly to a runway, which is in conflict with recommended RIM criteria.
4. The entrances to Runway 4R-22L at Taxiways Y9 and Y10 create a wide expanse of pavement where signage can potentially be located outside the view angle of a pilot's window. Additionally, these entrances lead directly to and from the air carrier apron. These elements conflict with recommended RIM criteria.
5. The intersection of Taxiways F, G, U, U7, and U8 creates a complex intersection with greater than 3 nodes. Additionally, the Runway 9L-27R crossing at Taxiway F is at an acute angle which can limit the visibility of the crossing aircraft and increases distance and travel time of the runway crossing.
6. The intersection of Taxiways G and V2 with Runway 9L-27R creates a wide expanse of pavement and is a high-energy runway crossing.
7. The intersection of Taxiways W and T5 with Runway 9R-27L is an area with a complex taxiway/runway intersection, wide expanse of pavement, and an acute angle crossing of the runway, which can limit the visibility of the crossing aircraft and increases distance and travel time of the runway crossing.
8. The intersection of Taxiways W2 and W3 with Runway 3R-21L creates a wide expanse of pavement where signage can potentially be located outside the view angle of a pilot's window. Additionally the co-location of the exit taxiways can potentially cause confusing geometry for taxiing pilots in low visibility conditions.
9. Taxiway PP1 leads directly from the de-icing apron to the Runway 3L-21R threshold.
10. Taxiway M6 leads directly from the de-icing apron to the Runway 3L-21R threshold.
11. Taxiway R leads directly from the air carrier apron directly to a runway, which is in conflict with recommended RIM criteria

HOT SPOT (HS):

1. The intersection of Runways 9L-27R and 4R-22L is identified as Hot Spot 1. Aircraft taxiing on Runway 9L-27R should be prepared to hold at the holding position markings on the runway.
2. The intersection of Runways 9L-27R and 3L-21R is identified as Hot Spot 2. Aircraft taxiing on Runway 9L-27R should be prepared to hold at the holding position markings on the runway.
3. The intersection of Taxiway F with Runway 3L-21R is identified as Hot Spot 3. Aircraft taxiing on Taxiway F sometimes enter Runway 3L-21R without clearance.

LEGEND

	RUNWAY PAVEMENT	ROFA	RUNWAY OBJECT FREE AREA	R/W	RUNWAY
	TAXIWAY / APRON PAVEMENT	RSA	RUNWAY SAFETY AREA		AIRPORT PROPERTY LINE
	OTHER PAVEMENT IN USE	TOFA	TAXIWAY OBJECT FREE AREA		HOT SPOT
	BUILDING - EXISTING - On Airport		FENCE		RUNWAY INCURSION MITIGATION (RIM) AREAS

North

0 1800' 3600'

Source: HNTB, March 2016

Figure 5-5
RUNWAY INCURSION MITIGATION (RIM) AREAS TO ADDRESS

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These runway incursion mitigation (RIM) areas on the airfield are identified on Figure 5-5. The intersections were identified based on their consistency with the RIM criteria presented above and in Chapter 4 of AC 150/5300-13A.

Implementing RIM solutions can often have the unintended consequence of reducing airfield capacity or increasing taxi time. The evaluation of alternatives will consider how proposed improvements affect airfield capacity and efficiency.

5.2.3.6 Runway Safety Areas

All of the Airport's existing runways meet FAA standards for compliant Runway Safety Areas (RSAs). The RSA requirement for Runway 9L is met via declared distances, which is in compliance with FAA standards and does not require physical improvements.

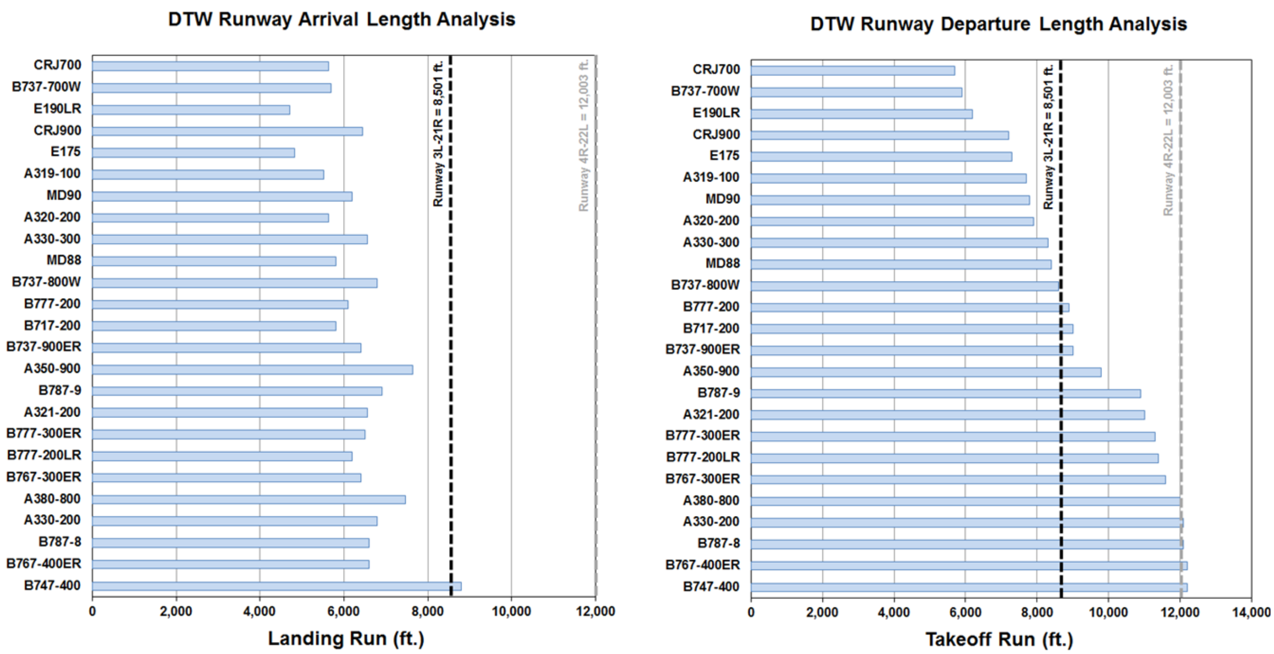
5.2.3.7 Runway Protection Zones

Appendix C of this report includes a series of tables summarizing a review of land uses within each of Metro's arrival and departure Runway Protection Zones (RPZs). The tables summarize whether or not the land use is contained within Airport property and/or if it is within the central portion of the RPZ. The tables also document whether or not the land use is allowable based on FAA guidance. Some examples of allowable land uses include NAVAIDs, which are fixed by function in order to support aircraft operations, service roads that are under control of the Airport and ATC, perimeter fencing, and below ground drainage features such as culverts. Of the 12 runway ends, 5 have RPZs with compatible land uses and do not require any improvements: Runways 4R, 3L, 21R, 9L, and 9R. The last column of each table identifies whether or not it is feasible to improve upon a non-compatible land use. There are several examples that were deemed not feasible to study further, including public roads, interstate highways, railroads, and occupied off-Airport buildings and its associated parking. Seven of the runway ends have non-compatible land uses in the RPZ for which it was determined not feasible for improvement, and only four of the seven runway ends with non-compatible land uses can be improved upon. Examples of these include off-Airport parking, trails, and vacant buildings. Potential improvements for these land uses will be considered in the alternatives analysis.

5.2.4 Runway Length Requirements

FAA standards prescribe that a runway should be long enough to accommodate landing and departures for the design aircraft. Figure 5-6 shows required runway lengths for typical aircraft that have significant operations the Airport. The chart is based on manufacturer's performance capabilities under "hot" temperature conditions (approximately 86 degrees F) and maximum takeoff weight (MTOW). The vertical lines indicate the lengths for the Airport's primary departure runways – Runways 4R-22L and 3L-21R. All of the runways provide sufficient length for landing aircraft. The 12,000-foot length of 4R-22L is sufficient for all the departing aircraft at the Airport with the slight exception of the B-747-400 and the B-767-400ER at MTOW. Discussions with members of the airfield technical subcommittee indicate the slight deficiency is not a problem for the trip lengths flown out of Detroit. The A-350-1000, which is the future critical aircraft, does not have finalized performance data available, but indications are that its runway length requirements will not exceed those of similar aircraft such as the B-787.

Figure 5-6
RUNWAY LENGTH REQUIREMENTS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: HNTB, May 2016.

The 8,500 foot length of Runway 3L-21R does not accommodate some of the departing aircraft typically using the Airport. However, the numbers of daily operations for these aircraft are relatively small, and these aircraft can use Runway 4R-22L for departure without affecting airfield capacity. One concern is that Runway 3L-21R is the only runway used for departures when the Airport is running triple simultaneous arrivals, which occur two to three times per day during peak arrival periods. When an aircraft cannot use Runway 3L-21R for departure, a gap in the arrival stream needs to be created on one of the other runways (typically 4R-22L). In addition, during winter operations when deicing is occurring, all aircraft from the North Terminal (aside from widebody aircraft) typically depart on Runway 3L-21R since they are required to use the Runway 21R deicing pad. Precipitation that requires deicing also affects takeoff performance, often increasing the required length beyond that indicated on Figure 5-6. If an aircraft needs another runway for departure there is a chance they will exceed their deicing holdover time while taxiing to the other runway and need to be deiced a second time.

Based on the above, the possible need to lengthen Runway 3L-21R was given careful consideration. However, it was determined that an extension of Runway 3L-21R is not warranted for the following reasons:

1. The Airport has three other runways with sufficient length for the majority of operations.
2. Potential impacts to capacity, such as the reduction in triple arrivals, only have temporary short-lived impacts.
3. The cost for the extension is significant; and since the only viable extension is to the north, the extension would affect the current rental car site and other facilities.

5.2.5 Deicing Pads and Remain Overnight Parking

Existing aircraft deicing pads and remain overnight parking (RON) areas are depicted on Figure 4-5 of Chapter 4, *Assessment of Existing Conditions*.

5.2.5.1 Deicing Pads

In 2013, FAA published an update to AC 150/5300-14C, Design of Aircraft Deicing Facilities. A gap analysis of the existing deicing pads was completed using the newer, updated standards. The Runway 4R, 3L, and 21R deicing pads are designed to ADG III standards and the Runway 22L pad is designed to ADG II standards, however, none of the existing pads provide clearance for a Vehicle Movement Area (VMA), which is a new criteria introduced in the updated AC. The lack of VMAs reduces the efficiency of the deicing operation and can add to the minimum time required to deice an aircraft during peak periods. The VMA allows for mobile deicing vehicles to complete deicing on both sides of the aircraft at the same time. In order to accommodate VMAs and maintain the existing number of deicing positions, the overall pad length would need to increase as follows: 4R – 105 feet; 3L – 86 feet; 21R – 78 feet; 22L west positions 76 feet; 22L east positions – 44 feet. Implementing VMAs on the existing deicing pads would result in the loss of one position at each pad**.**

Based on aviation activity forecasts and discussions with Airport users, it was determined that all of the current deicing spots are required and there is also a need for additional widebody aircraft deicing positions. This is based upon current deicing practices. The current practices are to use Delta staff to deice Delta mainline aircraft. A vendor deices Delta Connection aircraft and a second vendor deices non-Delta aircraft. Non-Delta SkyTeam aircraft (currently Virgin Atlantic and Air France) are also deiced by a vendor. The current practices require the different vendors to operate in distinct areas where they do not affect each other. The current requirements for deicing pads assume this same operating arrangement. The requirements indicate a need for one widebody deicing spot for the non-Delta/SkyTeam carriers and another widebody spot for SkyTeam/non-Delta aircraft. An analysis was completed to determine the additional space needed to add one widebody aircraft to an existing pad. Using the Airbus A350-1000 as the critical aircraft, the required additional pad length and width are 288 feet and 267 feet, respectively (or 76,896 square feet) for a 90 degree angle deicing pad. It is important to note that the widest existing deicing pad is 223 feet. One possibility to consider in the alternatives analysis is to park widebody aircraft at an angle on one of the existing ADG III deciding pads, similar to current operations on the Runway 4R deicing pad. This could affect narrowbody deicing and was studied in detail using simulation during the alternatives analysis.

5.2.5.2 Remain Overnight Parking

Remain overnight parking positions play an integral role in the operations and interactions between the airfield, passenger terminals, and cargo operations. RON positions provide aircraft with long or overnight layover times a place to park other than at the aircraft gate. At the McNamara Terminal RON positions are primarily used for international widebody aircraft, which spend more than three hours on the ground at the Airport. Conversely, at the North Terminal, the demand for RON positions comes from non-Delta carriers who park aircraft overnight between the last arrival of the day and the first departure on the subsequent day.

5.2.6 Potential Impacts of Technology and Industry Trends

There is a variety of technological advancements and industry changes that could have an impact on airfield facilities at the Airport. Key among these is technological improvements to the air traffic control system that are part of FAA's Next Generation Air Transportation System (NextGen) development program, which has been underway since the late 1990s.* One of the central facets of NextGen is the transformation of the U.S. air traffic control system from ground-based navigation aids to satellite-based navigation aids. This transformation—which is already taking place in the en route airspace and at select airports—will increase the accuracy of aircraft navigation and provide more flexible, robust air traffic procedures. The transformation to satellite-based navigation will also reduce or eliminate the need for ground based navigational aids such as VOR antennas, glide slope antennas, and localizer antennas.

Another facet of NextGen is to increase the availability and currency of air traffic data to all users of the air transportation system. This includes providing pilots with in-cockpit displays of air traffic information, so pilots can react to such information directly, and providing air traffic controllers with instantaneous aircraft position information obtained via satellite-based navigation systems, rather than via ground-based radar systems. A technology known as "automated dependent surveillance-broadcast" (ADS-B) is central in this effort. ADS-B utilizes radio transponders that broadcast detailed information regarding aircraft position, speed, altitude, type, and other information to ADS-B receivers. Such receivers can be located aboard aircraft and in air traffic control facilities. The ground infrastructure for ADS-B is now in place in the United States and all aircraft operating in the ATC environment and specified controlled airspace are mandated to have onboard "ADS-B Out" equipment installed and operating by 2020.

A third important facet of NextGen is to automate and optimize traffic flows both in the terminal and en route airspace environments, enabling pilots and controllers to do more with the same volume of airspace. This optimization, which relies in part on the other two facets of NextGen that have already been mentioned, is expected to allow controllers to sequence aircraft to arrival and departure runways more effectively, helping to ensure that available airspace and airfield capacity is not wasted because aircraft aren't fed through the air traffic system effectively enough to use it.

Delta has been a strong supporter of many of the NextGen capabilities and has helped implement NextGen procedures at its Atlanta and Minneapolis hubs and other significant airports.

- Satellite-based approach procedures that can facilitate instrument approach procedures in low visibility to runways not currently equipped with CAT III ILSs.
- Wake vortex detection and avoidance systems that enable wake-turbulence related in-trail separations and runway dependencies to be reduced when wind and weather conditions are favorable.
- ADS-B-based flight procedures and air traffic control rules that enable pilots to assume responsibility for their own separations from other aircraft, even in IMC conditions, facilitating "near-visual" operations in poor weather.
- Use of optimized descent profile approach procedures to reduce fuel burn, aircraft emissions, and possibly noise impacts associated with Airport arrivals.

*A complete and current description of proposed NextGen program improvements, enabling technologies, and implementation timelines is presented in the report, Next Generation Air Transportation System Integrated Work Plan: A Functional Outline, Version 1.0, published by the Joint Planning and Development Office (JPDO), on September 30, 2008.

- Optimized taxiway routing and taxiway conflict management, utilizing data obtained from the ASDE-X ground surveillance system.

Some of these improvements will be enabled via facility and equipment improvements that are already planned for the Airport. However, much of the promise of NextGen will depend on the rates at which aircraft operators equip their aircraft to take advantage of NextGen capabilities.

From the perspective of the Master Plan Update, there are two actions that the Authority can take in the near-term to better prepare itself for NextGen flight procedures and operational capabilities.

- To take advantage of new generation approach and departure procedures, prepare a comprehensive map of airspace obstructions in the vicinity of the Airport. This is being done as part of the ALP process and will provide FAA with the information it needs to efficiently implement new NextGen procedures.

- Plan airfield geometry that provides ATC with good flexibility in putting aircraft into the proper sequence for departure, or for quickly changing an aircraft's departure sequence. Proper sequencing for departure provides ATC with the capability to take advantage of multiple departure routes (a major benefit of NextGen). Multiple departure routes are most effective when successive aircraft can go on a different departure route. When two successive aircraft need to be on the same departure route (based upon their destinations) a greater amount of time between departures is required. Changing an aircraft's departure sequence will become more important in NextGen due to NextGen's ability to sequence aircraft into en route airspace "slots." The slots can sometimes change quickly and having the ability to get an aircraft airborne quickly to fit into a slot will be advantageous. This geometric consideration will be considered in alternatives while addressing other airfield requirements.

In the longer term, it is recommended that the Authority monitor the progress of the FAA's NextGen program and actively collaborate with FAA to determine when additional new technologies should be installed at the Airport and who should be responsible for their implementation.

5.3 PASSENGER TERMINAL FACILITIES

The assessment of passenger terminal facility requirements was based on the following primary objectives:

- Assess the need for additional capacity in the McNamara and North terminals separately.

- Determine if existing gate infrastructure given usage and trends are sufficient to meet future demand; and if infrastructure is not sufficient, assess the additional gates or change in usage that would be required to meet demand.

- Accommodate potential changes to the future fleet mix, particularly upgauging of the future aircraft fleet.

- Accommodate existing and forecast future peak hour passenger flows through key terminal functional areas.

The passenger terminal requirements focused on the following four functional areas: aircraft gates and RON positions; airline check-in and bag drop units; passenger SSCPs; and Federal Inspection Services facilities.

5.3.1 Methodologies and Key Assumptions

The following summarizes the methodologies, and key assumptions used to determine passenger terminal facility requirements.

Terminal facility requirements for check-in, security screening, and FIS were developed using a spreadsheet-based model. This model is based on the planning guidelines published in the Airport Cooperative Research Program (ACRP) Report 25: *Airport Passenger Terminal Planning and Design,* developed by the Transportation Research Board (TRB), and supplemented by benchmarks for comparable airports, industry-wide trends, data and previous planning studies provided by Airport staff, and site observations of existing conditions.

For planning purposes, it is assumed that future terminal facilities will be developed to meet Level of Service (LoS) “Optimum” standard as defined in the 10th edition of the International Air Transport Association’s (IATA) Airport Development Reference Manual (ADRM). General planning factors as recommended on the IATA Level of Service framework were assumed in the development of facility requirements. Level of service is a measure of the quality of service provided to customers inside the terminal in terms of ease of flows and delays. LoS “Optimum” corresponds to a situation of overall good levels of service, where flows are stable, delays are acceptable, and a good level of comfort is provided.

5.3.1.1 Peak-Hour Passenger Activities

Terminal facility requirements are primarily driven by forecast peak-hour passenger demand. Forecasts of peak hour passengers and passenger airline aircraft operations were developed using published airline schedules for a representative day in 2015 (the base year). Table 5-4 summarizes the baseline and forecast peak-hour passenger demands for each PAL based on scheduled seats and an assumed annual average load factor of 85%.

Table 5-4
PEAK-HOUR PASSENGER ACTIVITY
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Baseline 2015	PAL 1 2020	PAL 2 2025	PAL 3 2035
Airport total	7,009	7,465	8,534	9,418
McNamara	2,698	3,094	3,452	3,794
Departures	1,051	1,191	1,337	1,465
Arrivals	1,667	1,924	2,130	2,353
North	4,311	4,371	5,082	5,625
Departures	1,842	1,913	2,197	2,287
Arrivals	2,674	2,710	3,179	3,480

Source: LeighFisher, July 2016.

5.3.1.2 Aircraft Gate Requirements Methodology and Assumptions

Aircraft gate requirements are assessed by analyzing the ADPM flight schedule. Baseline and future flights schedules are provided in Appendix F. Aircraft gate requirements were developed using a proprietary gate model that allocates scheduled flights to terminal gates and remote aircraft parking positions based on assumed operational parameters. Aircraft gate demand is derived by analyzing the simultaneous number of aircraft unloading and loading passengers at the terminals by airline and aircraft type.

A gate is defined as any aircraft parking position used by airlines for loading and unloading passengers, and a RON position is defined as any aircraft parking position used only for staging idle aircraft. RON parking is either by an aircraft that is scheduled to be on the ground for longer than 2 hours (e.g., international flights) or aircraft that remain overnight. The analysis is dependent on a number of key assumptions, including:

- A schedule of matched flight arrival and departure operations and an inventory of available gates and remote positions at each terminal.
- Physical constraints that stipulate which flights are permitted to use which gates based on maximum allowable aircraft length and width; position or height of loading bridges; and dependencies between adjacent gate positions that would restrict operations.
- Airport policies describing which airlines are allowed to use which gates, including policies that allow aircraft from any airline to use certain “common use” gates.
- Assumptions for aircraft passenger unloading and loading times, tow times, and buffer times that describe the minimum amount of time typically reserved between successive aircraft operations on a gate.
- Assumptions regarding airline use of RON positions, particularly the length of time aircraft are allowed to dwell at a gate before being towed to a RON position.

Maneuvering buffer, defined as the time for an aircraft to maneuver into and out of a gate, is assumed to be five minutes. Schedule buffer, defined as the time to allow for early or late arrivals, is assumed to be 10 minutes for flights to North America and 20 minutes for all others. Minimum gate times, defined as the minimum amount of time that an aircraft requires a gate for an arrival, departure, or full turn operation before it can be towed to a RON position is assumed to vary by airline, aircraft type, and sector as summarized in Table 5-5. Holdover tow time threshold, defined as the maximum amount of time an airline would allow an aircraft to dwell at a gate before the airline would tow the aircraft to a remote parking position, is assumed to be two hours.

Table 5-5
MINIMUM GATE TIME ASSUMPTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Airline	Aircraft class	Sector	Arrival time (mins)	Departure time (mins)	Full turn – arrival and departure (mins)
All	Widebody	All	50	50	60
Delta	Narrowbody	International	30	30	40
Delta	Narrowbody	Domestic a precleared	30	30	40
All Others	Narrowbody	Domestic	40	40	50
Delta	Regional jets	International	30	30	40
Delta	Regional jets	Domestic & precleared	25	25	30

Source: LeighFisher, July 2016.

Terminal and RON positions are summarized using a combination of existing inventory and known future projects. Table 5-6 shows the available inventory of aircraft contact gates by terminal and aircraft design group compatibility. It should be noted that McNamara Terminal Concourse C has 15 gates that are currently inactive. Also, design is currently underway for three additional contact gates at the north end of North Terminal, which are expected to be operational by PAL 1, and therefore considered as available in the gate inventory for the future flight schedules.

The need for contact gates is also closely associated with the number of RON positions. At some airports, nearly all aircraft can be simultaneously accommodated by contact gates, which provide a high level of service to airlines and passenger. However, at other airports there are only enough contact gates for the number of aircraft being simultaneously loaded, and RON positions provide capacity for aircraft that are idle or being stored for flights later in the day. Since RON positions are typically associated with lower capital and maintenance costs than contact gates, some airports choose to provide remote parking positions to reduce costs while accommodating flight schedules.

RON positions are found in five distinct apron areas of the airfield, shown in Table 5-7. Each remote apron is used by a different primary user group, as noted in the table.

Gate requirements are summarized in Section 5.3.2.1 for the McNamara Terminal and Section 5.3.3.1 for the North Terminal.

Table 5-6
EXISTING TERMINAL CONTACT GATES BY AIRCRAFT DESIGN GROUP
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Aircraft Design Group (ADG)				
	II	III	IV	V	Total
McNamara					
Concourse A		38	11	14	63
Concourse B		17			17
Concourse C	21	19	__	__	40
Total	21	74	11	14	120
North Terminal					
Concourse D (*a*)		13	14	2	29

(a) Assumes three new ADG-III gates in place by PAL 1

Source: LeighFisher, July 2016.

Table 5-7
REMAIN OVERNIGHT POSITIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

		Aircraft Design Group (ADG)				
Remote aprons	Primary user group	II	III	IV	V	Total
A (adjacent to Delta Cargo)	Delta Cargo		4	1		5
B (adjacent to North Terminal)	Common use	2	5	2	2	11
C (adjacent to taxiway Zulu)	Common use			2		2
D (southeast portion of the airfield)	Common use				2	2
E (adjacent to McNamara Concourse C)	Delta + SkyTeam Partners	__	__	3	1	4
Total		2	9	8	5	24

Source: LeighFisher, July 2016.

5.3.1.3 Passenger Check-in Assumptions

Passenger check-in facility requirements were derived based on peak 30 minute departing passenger volumes and were determined with exclusive-use check-in facilities prevailing in both terminals, except for a few common-use check-in positions in the North Terminal. Passenger airline status (premier/non-premier) was not considered.

It is widely recognized that mobile and remote check-in will gradually increase as passengers become more reliant on their personal electronic devices to provide these services. Considering other emerging technologies for the check-in process, it is assumed that the need for full-service check-in counters and kiosks will decrease over time. Table 5-8 shows the percentage of originating passengers projected to use each of the major types of check-in facilities during the planning period.

Table 5-8
PERCENTAGE OF ORIGINATING PASSENGERS USING CHECK-IN FACILITIES BY TYPE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Check-In Types	Baseline 2015	PAL 1 2020	PAL 2 2025	PAL 3 2035
Full-service counters	10	10	8	8
Self-service kiosks	40	30	20	10
Off-site/mobile/online with bags	20	30	42	52
Off-site/mobile/online no bags, direct to security screening checkpoint	18	18	20	20
Curbside	12	12	10	10
Total	100	100	100	100

Source: LeighFisher, July 2016.

Check-in transaction times and desired maximum wait times were referenced both from the IATA ADRM recommendations for LoS "Optimum" standard and benchmarking other large-hub airports. The physical space required is comprised of areas needed to accommodate airline employees and equipment, passengers actively checking in at each location, and passengers queuing. Passenger queuing is calculated based on maximum number of passengers in the queue multiplied by 16 square feet per passenger as recommended for LoS "Optimum" standard.

A typical check-in layout module is provided on Figure 5-7, which is used to calculate space required for each check-in function. Specific airline check-in requirements were not accounted for in this analysis. Rather, generic space allocated to serve each check-in mode was applied to project future program requirements. For example, a typical linear full-service check-in counter is assumed to be three feet wide with a three feet wide bag well on the side. The total check-in area consists of an 8.0-foot-deep active check-in area, a 3.0-foot-deep counter, and another 8.5 feet of space behind the counter for bag belt and agent circulation. Sufficient space is also provided to accommodate self-service bag drop units shall this system be approved for future operation in the United States.

As check-in processing continues to shift from airlines to the passenger via mobile devices, online and offsite check-in, check-in demand in pre-secure terminal space will decrease over time. Thus, with the decline of cash transactions at the ticketing lobby and a continual shift in check-in operations away from the counter, Airline Ticket Offices (ATOs) are no longer necessary to be directly behind the counters to support ticketing operations it once served. This allows ATOs to be more flexible in their locations, potentially relocated to a secondary space, freeing up space in the terminal for other revenue producing functions. ATO space is assumed to decrease gradually over the planning period, from 90% in the baseline year to 70% of the total check-in area required at PAL 3. In addition, approximately 35-45% of the overall check-in area should be allocated to general circulation within the planning period.

Figure 5-7
CHECK-IN LAYOUT MODULE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Source: LeighFisher, July 2016.

5.3.1.4 *Security Screening Checkpoint Assumptions*

The McNamara Terminal currently operates four separate checkpoints designated for originating passengers: 2 lanes on Level 2, 4 lanes on Level 3 south, 4 lanes on Level 3 north, and 1 lane inside the Westin Hotel for a total of 11 lanes. The North Terminal operates two checkpoints, one on the North and one on the South, each occupying 5 lanes. The checkpoints connect each terminal's ticketing lobby to its passenger concourses. It is assumed that these checkpoints will continue to operate separately for the purpose of this master plan. The assumed passenger utilization distribution among the four McNamara checkpoints is: 20% on Level 2, 35% each on Level 3 north and south, and 10% in the Westin Hotel. It is assumed that the two North Terminal checkpoints each accommodate 50% of the total passengers.

Future passenger SSCP requirements were determined based on the following planning guidelines and assumptions:

- An average throughput of 150 persons per lane per hour was assumed for regular checkpoint lanes; whereas, an average throughput of 250 persons per lane per hour was assumed for expedited TSA PreCheck and CLEAR lanes.*

*Based on observations at Airports nationwide and recommendations provided in ACRP Report 25, *Airport Passenger Terminal Planning and Design*.

- 45% of the SSCP passengers were assumed to use regular checkpoint lanes while 40% will go through TSA PreCheck lanes, and the remaining 15% were assumed to process through the privately operated CLEAR security screening program throughout the planning period.

- CLEAR will occupy a dedicated lane at both the North Terminal checkpoints and the two checkpoints on Level 3 of the McNamara, where a majority of the passengers is anticipated to be processed.

- Employee screening demand was added to the passenger volumes at all checkpoints and assumed to be 15% of daily enplanements.

- Passengers can wait a maximum of ten minutes for security screening. Passengers will occupy 13 square feet per person of space while waiting in queue.

- Passengers will utilize the SSCP located in the terminal in which they check-in regardless of congestion. Active management of passenger queues to redirect passengers to checkpoints with less congestion could reduce overall screening wait times.

Space requirements for SSCPs are comprised of active security screening and passenger queuing. The space required for active security screening is based on a two-lane module measuring 28-feet in width and 100-feet in length, as shown on Figure 5-8. To maintain service levels, it was assumed that passengers can wait a maximum of 10 minutes at the queue prior to screening. A 15% allowance is also provided to anticipate future screening equipment modifications and expansion, as suggested in the TSA's *Recommended Security Guidelines for Airport Planning, Design and Construction*, (May 1, 2011).

5.3.1.5 Federal Inspection Services Facility Assumptions

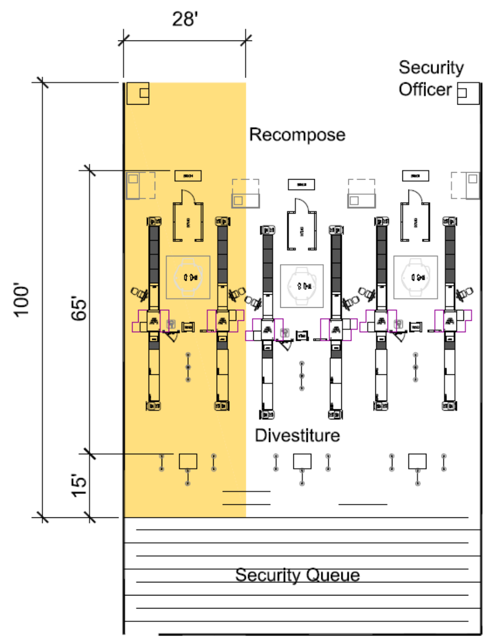
FIS facilities are located at both terminals, which provide primary (immigration) and secondary (customs) screening of passengers and baggage. The facilities also includes baggage re-check areas for connecting passengers and a separate passenger SSCP dedicated to international connecting passengers at the McNamara Terminal. Key assumptions for FIS operation at both terminals include:

- Arriving International passengers from each individual airline are combined by terminal.

- An immigration booth is a piggyback booth that accommodates two agents, and capable of processing 100 passengers per hour (per piggyback booth).

To account for peak hour FIS passenger flows, it was assumed that passengers deplane from international arriving flights within 20 minutes of aircraft arrival. It should be noted that peak passenger flows do not coincide with outbound enplaning peaks.

Figure 5-8
SECURITY SCREENING CHECKPOINT MODULE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: LeighFisher, July 2016.

5.3.2 McNamara Terminal

The following summarizes the future facility requirements for the McNamara Terminal.

5.3.2.1 Aircraft Gate and Remote Parking Position Requirements

Based on the assumptions described in Section 5.3.1.2, there is no need for additional gates at the McNamara Terminal within the planning horizon. However, some requirements for modifications to existing gates are required. Table 5-9 summarizes the gate requirements for Delta and SkyTeam partners using the McNamara Terminal**.**

The future PAL 1 flight schedule indicates a need for up to three ADG-V gates with FIS access to accommodate A-350-900 aircraft; however, it is assumed that existing ADG-V gates are adequately sized to accommodate the new aircraft type. Based on input provided by Delta Air Lines representatives, the A-350-1000 aircraft, which is approximately 10-feet longer and 1-foot wider than existing ADG-V gates, does not need to be accommodated. The future PAL 3 flight schedule indicates an increase in the number of widebody (ADG-IV and ADG-V) aircraft serving the McNamara terminal. As a result, the requirements reflect an increased need in the number of widebody contact gates in PAL 3 over PAL 1. Requirements are also sensitive to the number of ADG-III and ADG-IV aircraft using ADG-IV and ADG-V gates.

Table 5-9
GATE REQUIREMENTS – McNAMARA TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Aircraft Design Group (ADG)	Existing (Active)	PAL 1	PAL 2	PAL 3
II	21 (27)	36	17	19
III	74 (52)	43	65	71
IV	11 (11)	8	6	0
V	14 (14)	7	9	11
Total	120 (104)	94	97	101

Note: All gate requirements include an 8% increase above the output from the gate model, which reflects a typical operating gate supply buffer used by Delta at other major hubs such as Atlanta.

Source: LeighFisher, July 2016.

The total PAL 3 gate requirements for ADG-III or larger contact gates is 82 (71+11). Since there is a total of 77 active ADG-III and larger aircraft gates today (52 ADG-IIIs, 11 ADG-IVs, and 14 ADG-Vs), 5 new gates will be needed to accommodate future demand. However, with the 8 additional ADG-II gates that are not needed to meet future demand, the 5 required gates can likely be accommodated by up-gauging smaller aircraft (ADG-II) gates.

Requirements shown in Table 5-9 assume that contact gates will be used with higher frequency (turns per day) than current PAL 1 conditions. The general trend towards upgauging of the aircraft fleet mix, particularly the elimination of RJ200 aircraft from the future flight schedules, also eliminates the need for ADG-II gates, which are currently provided at Concourse C.

Table 5-10 shows the number of RON positions that would be required to accommodate the future flight schedules. The RON requirements in the table also represent a buffer space for irregular operations. It should be noted that the RON requirements at McNamara Terminal are primarily driven arrival banks and subsequent departure patterns. When the rate of arriving aircraft exceeds the rate of departing aircraft, the number of total aircraft on the ground can exceed the number of contact gates. One example of this is international widebody flights, which often have long layover times. Since the Airport serves as a major hub for Delta operations, the need for overnight parking of ADG-III aircraft does not exceed the available capacity of contact gates and RON positions in the planning horizon.

5.3.2.2 Passenger Check-in Requirements

Table 5-11 summarizes the check-in requirements at the McNamara Terminal throughout the planning period. The existing check-in facilities at McNamara are more than sufficient to handle demand beyond the 20-year planning period. Approximately 12,000 square feet of space is needed to meet the Baseline requirement. By PAL 3, that demand increases to 15,400 square feet. Space not needed to meet future demand can either be repurposed for a centralized SSCP on Level 3 departures to consolidate security staffing or can be reconfigured as additional tenant space or Airport support functions, which will be studied in the alternatives development phase.

Table 5-10
REMOTE AIRCRAFT PARKING REQUIREMENTS – McNAMARA TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Aircraft Design Group (ADG)	Existing *(a)*	Baseline	PAL 1 2020	PAL 2 2025	PAL 3 2035
III	19	20	21	22	22
V	4	4	5	5	6
Total	23	24	26	27	28

(a) Includes shared use RON positions.

Source: LeighFisher, July 2016.

Table 5-11
CHECK-IN REQUIREMENTS – McNAMARA TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Existing	Baseline 2015	PAL 1 2020	PAL 2 2025	PAL 3 2035
Unit requirements (positions)					
Full-service	84 *(a)*	7	7	7	7
Kiosks	49	23	20	15	10
Bag drop		14	23	35	47
Curbside		4	5	5	5
Subtotal positions	133	48	55	62	69
Space requirements (sf)*(b)*					
Check-in area	11,870	6,200	6,800	7,100	7,500
Airline ticket office	16,190	3,400	3,700	4,100	4,500
Circulation		2,200	2,800	2,900	3,400
Subtotal area	28,060	11,800	13,300	14,100	15,400

(a) Existing full-service positions include bag drop areas.
(b) Rounded to the nearest hundreds.

Source: LeighFisher, July 2016.

5.3.2.3 Passenger Security Screening Checkpoint Requirements

The four passenger SSCPs at the McNamara Terminal currently provide a total of 11 security lanes and approximately 18,500 square feet of active screening and passenger queuing space. These checkpoints are vertically separated and each dedicated to a different passenger type (e.g., TSA PreCheck, employee/crew, and passengers going straight to security screening with no bags to check). It is assumed that PreCheck and CLEAR will each occupy dedicated lanes on the two checkpoints at Level 3 Departures, while both will share one lane on Level 2 and the Westin Hotel checkpoints.

Table 5-12 summarizes the security screening requirements at McNamara Terminal. Assuming 55% of total passengers will go through expedited screening, an additional lane to accommodate expedited processing is needed at the Westin Hotel. By PAL 3, one additional lane will be required on the Level 2 checkpoint. However, the space required to accommodate future screening equipment and unanticipated change in screening protocols is anticipated to increase over the planning period. Approximately 24,400 square feet is needed to accommodate additional screening, queuing and support spaces required by PAL 3 – about 30% more than the existing footprint.

Table 5-12
SECURITY SCREENING REQUIREMENTS – McNAMARA TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Existing	Baseline	PAL 1	PAL 2	PAL 3
Checkpoint lanes	11	12	12	12	13
Level 2	2	2	2	2	3
Level 3 North	4	4	4	4	4
Level 3 South	4	4	4	4	4
Westin	1	2	2	2	2
Screening areas (sf) *(a)*		16,800	16,800	16,800	18,200
Queuing area (sf)		700	1,100	1,900	1,600
Support allowance (sf)		4,200	4,200	4,200	4,600
Total SSCP area	18,500	21,700	22,100	22,900	24,400

(a) Rounded to the nearest hundred.

Source: LeighFisher, July 2016.

5.3.2.4 Federal Inspection Services Facility Requirements

There are currently 30 piggyback booths for FIS primary processing, located on the first floor in the central core of the terminal. Sterile corridors connect international arrival gates to the FIS passenger processing facility. Customs and Border Protection staff has indicated that the existing McNamara FIS facility is designed to handle up to 2,000 passengers per hour. The peak hour forecast for international arriving passengers is not anticipated to exceed 600 passengers by PAL 3 (2035). Therefore, the existing FIS facility is more than adequate to handle future international demand even beyond the 20-year planning horizon.

5.3.3 North Terminal

The following sections summarize the facility requirements for the North Terminal.

5.3.3.1 Aircraft Gate Requirements

The inventory of North Terminal gates consists of 10 ADG-III, 14 ADV-IV, and 2 ADG-V aircraft for a total of 26 gates, which can accommodate the baseline flight schedule. Four gates (D3, D5, D7, and D10) are FIS compatible with a sterile corridor connecting the gate to the CBP checkpoint on the lower level.

The North Terminal currently accommodates all non-Delta SkyTeam airlines, and therefore, gate requirements are sensitive to Airport policies and rules regarding gate usage. Table 5-13 summarizes the current utilization of each gate. For purposes of developing gate requirements, it was assumed that the existing airline gate allocation is maintained in future PALs. Since it is unknown which airline(s) will occupy the three new gates at the north end of the North Terminal, it is assumed these additional ADG-III gates will be operated as "common-use" gates throughout the planning period.

Table 5-13
EXISTING NORTH TERMINAL AIRLINE GATE ALLOCATION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Airline	Gate #	Total
United Airlines	D1, D2, D4, D6	4
Spirit Airlines	D8, D11, D12, D14	4
jetBlue Airways	D15	1
Frontier Airlines	D16	1
Southwest Airlines	D19, D20, D21, D23	4
American Airlines	D18, D24, D25, D26, D28, D30, D32	7
Air Canada	Common Use Only	
Alaska Airlines	Common Use Only	
Lufthansa Airlines	Common Use Only	
Royal Jordanian Airlines	Common Use Only	
Common use gates *(a)*	D3, D5, D9, D10, D17	5
Total gates		26

Note: All incoming international flights that are not pre-cleared have to use common use gates D3, D5, D9, or D10, which have FIS access.

(a) Any North Terminal airline can use a common use gate, as needed.

Source: LeighFisher, July 2016.

RON position requirements at the North Terminal are largely driven by the morning departure peak. Since Detroit is primarily a non-hub for most North Terminal airlines, many airlines desire an early morning flight to their hubs, which is reflected in the baseline and future flight schedules. Table 5-15 shows the number of RON positions required by aircraft size. As with contact gates, it is prudent to consider additional unforeseen demand, particularly for ADG-V remote aircraft parking. Therefore, new ADG-III/IV RON positions should be designed for ADG-V compatibility.

Table 5-14

GATE REQUIREMENTS – NORTH TERMINAL

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

Aircraft Design Group (ADG)	Existing	Baseline	PAL 1	PAL 2	PAL 3
III/IV	10/14	25	26	27	28
V	2	1	1	1	1
Total	26	26	27	28	29

Source: LeighFisher, July 2016.

Table 5-15

REMAIN OVERNIGHT PARKING REQUIREMENTS – NORTH TERMINAL

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

Aircraft Design Group (ADG)	Existing	Baseline	PAL 1	PAL 2	PAL 3
III/IV	12	14	15	15	16
V	0	0	0	0	0
Total	12	14	15	15	16

Source: LeighFisher, July 2016.

5.3.3.2 Passenger Check-in Requirements

Table 5-16 summarizes the check-in requirements at the North Terminal throughout the planning period. There are currently 86 full-service counters and 24 kiosks at the North Terminal passenger check-in facility, occupying approximately 17,630 square feet of check-in area in total. Several counter and kiosk positions function as common-use (shared between international carriers), while the majority of positions are dedicated for exclusive airline use. If sharing of check-in facilities among airlines increases, total space requirements indicated in Table 5-16 could potentially decrease.

As shown in Table 5-16, the existing check-in facility (at approximately 36,500 square feet) is more than adequate to accommodate passenger demands throughout the planning period. This indicates that a portion of the existing check-in facility can be repurposed for other revenue generating functions, such as leasable tenant spaces, small coffee shop type concessions for meeters/greeters or Airport/airline employees to name a few.

Table 5-16
CHECK-IN REQUIREMENTS – NORTH TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Existing	Baseline	PAL 1 2020	PAL 2 2025	PAL 3 2035
Unit requirements (positions)					
Full-service	86 *(a)*	12	12	12	12
Kiosks	24	42	32	25	16
Bag drop		25	35	53	71
Curbside		9	9	9	9
Subtotal positions	110	88	88	99	108
Space requirements (sf) *(b)*					
Check-in area	17,630	9,700	10,300	10,800	11,400
Airline ticket office	18,860	5,600	5,500	6,100	6,800
Circulation		3,400	4,100	4,400	5,200
Subtotal area	36,490	18,700	19,900	21,300	23,400

(a) Existing full-service positions include bag drop areas.
(b) Rounded to the nearest hundreds.

Source: LeighFisher, July 2016.

5.3.3.3 Passenger Security Screening Checkpoint Requirements

There are a total of 10 security screening lanes evenly distributed at two checkpoint locations – on the north and south sides of the North Terminal, occupying a total of approximately 18,200 square feet. It is assumed that both checkpoints will continue to operate separately throughout the planning period.

Table 5-17 summarizes the security screening requirements at North Terminal. Assuming 55% of the passengers go through TSA PreCheck and CLEAR, with each having dedicated lanes, and the other 45% process through the regular checkpoint, results indicate that two additional lanes are required at each bank in the Baseline year. This translates to a total of approximately 27,000 square feet of security screening areas required for active screening, queueing, and TSA support. By PAL 3, four additional lanes are required to accommodate passenger demands at each bank, with a total of approximately 34,000 square feet of space needed – about 85% more than the existing area allocated for security screening today.

5.3.3.4 Federal Inspection Services Facility Requirements

There are currently seven piggyback booths for FIS primary processing, located on the first floor and south end of the terminal. Sterile corridors connect the international arrival gates to the FIS passenger processing facility. Customs and Border Protection staff has indicated that the existing FIS passenger processing capacity is approximately 700 passengers per hour. The forecast flight schedule features only one simultaneous inbound international aircraft. Therefore, the peak hour international arriving passenger flow is not anticipated to exceed 250 passengers, or the capacity of a single flight, should aircraft types change in the future. Even if two inbound international aircraft arrive simultaneously in a future flight schedule, the FIS facility at North Terminal should be adequately sized to meet demand.

Table 5-17
SECURITY SCREENING REQUIREMENTS – NORTH TERMINAL
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Existing	Baseline	PAL 1	PAL 2	PAL 3
Checkpoint lanes	10	14	14	16	18
North	5	7	7	8	9
South	5	7	7	8	9
Screening areas (sf) *(a)*	12,600	19,600	19,600	22,400	25,200
Queuing area (sf)	4,630	2,500	2,900	2,900	2,400
Support allowance (sf)	970	4,900	4,900	5,600	6,300
Total SSCP area	18,200	27,000	27,400	30,900	33,900

(a) Rounded to nearest hundreds.

Source: LeighFisher, July 2016.

5.4 GROUND TRANSPORTATION AND PARKING

The following summarizes estimated requirements for roadways, curbsides, parking, and rental car facilities. Requirements were developed based on collected data, anecdotal information from Authority staff and stakeholders, experience at comparable airports, previous studies commissioned by the Authority, and industry standards for an acceptable LOS throughout the planning period.

5.4.1 Terminal Roadways

Terminal access roadway requirements are based on an analysis of the current and projected peak hour traffic volumes along individual roadway segments. For each roadway segment the projected peak or design hour vehicle volume was compared to the hourly capacity of the roadway to determine the volume to capacity (v/c) ratio. The capacity is dependent upon the number of lanes and posted speed limit or typical speed of vehicles along each segment. Typically, highways that accommodate vehicles at a high speed have a higher capacity than arterial roadways, which are subject to slower speeds. As traffic enters the terminal area, the decreased speeds approaching the terminal curbside and the number of decision points (e.g., parking and rental car entrances) affect the roadway capacity.*

The Airport's roadways were analyzed using a 30 mph LOS criteria from ACRP Report 40, *Airport Curbside and Terminal Area Roadway Operations*, as summarized in Table 5-18. Portions of the roadway, such as along John D. Dingell Drive between the North and McNamara Terminals are signed for faster speeds such as 45 mph, however, an initial analysis was completed using the slower speed threshold to identify issues in the Airport network. A higher overall capacity was assumed along these roadways to reflect the higher speeds and fewer decision points.

*The standard Highway Capacity Manual (HCM) LOS table was developed for highways and uses a minimum speed of 45 mph. Since airport access roadways are typically signed for 35 mph or less (the posted speed limit at the Airport is 25 mph) the HCM table does not always result in an accurate representation of LOS on airport roadways. ACRP Report 40, *Airport Curbside and Terminal Area Roadway Operations,* summarizes roadway operating conditions along airport roadways and assigned capacities and LOS criteria that are more representative of airport environs.

Table 5-18

LEVELS OF SERVICE FOR AIRPORT TERMINAL AREA ACCESS ROADWAYS (30 MPH)

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

Volume/capacity ratio	Level of Service
0.00-0.26	A
0.26-0.41	B
0.41-0.60	C
0.60-0.79	D
0.79-1.00	E
1.00-5.00	F

Source: ACRP 40, *Airport Curbside and Terminal Area Roadway Operations,* Table 5-18, based on information presented in Transportation Research Board, National Research Council, *Highway Capacity Manual,* Exhibits 21-2 and 21-3, December 2000.

ACRP Report 40 uses letters A through F to identify operational performance with LOS A representing free flow conditions with no delay and LOS F representing gridlock situations with a v/c ratio over 1.0. Roadway lane requirements were developed assuming a target LOS D. The LOS of a roadway segment is determined by the peak or design hour traffic volume divided by the hourly capacity of the segment. If the LOS of a segment decreases below LOS D additional lanes would be needed. For any segments operating at LOS E or F, the number of lanes required to achieve an acceptable LOS D or better was calculated.

The existing peak hour volumes collected in January 2016 were increased by the respective originating and terminating passenger growth during the design day AM or PM peak-hour at each terminal for each PAL. Since the GTCs serve both departing and arriving passengers, the projected traffic volumes at the GTCs were assumed to grow at the same rate as the total originating and terminating passenger growth during the design day AM or PM peak-hour at their corresponding terminal.

The existing and projected traffic volumes, v/c ratio and associated level of service for roadway segments in the terminal area are summarized in Table 5-19. The terminal access roadways are projected to operate at LOS B or better throughout the planning horizon and have sufficient capacity to provide an acceptable level-of-service through PAL 3.

Table 5-19
PASSENGER TERMINAL AREA ROADWAY REQUIREMENTS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Existing Capacity		Baseline (2016)				PAL 1 (2020)				PAL 2 (2025)				PAL 3 (2035)			
Description	Lanes	Capacity (veh/hr)	Demand (veh/hr)	V/C ratio	LOS	Required Lanes	Demand (veh/hr)	V/C ratio	LOS	Required Lanes	Demand (veh/hr)	V/C ratio	LOS	Required Lanes	Demand (veh/hr)	V/C ratio	LOS	Required Lanes
McNamara Terminal departure between Merge & 5-lane widening	3	3,000	772	0.26	A	3	793	0.26	B	3	799	0.27	B	3	892	0.30	B	3
McNamara Terminal arrival between Merge & 5-lane widening	3	3,000	524	0.17	A	3	566	0.19	A	3	593	0.20	A	3	627	0.21	A	3
McNamara Terminal GTC between merge & operating Curbside	1	1,000	277	0.28	B	1	299	0.30	B	1	312	0.31	B	1	329	0.33	B	1
McNamara Terminal international arrivals between merge & 5-lane widening	3	3,000	624	0.21	A	3	636	0.21	A	3	640	0.21	A	3	751	0.25	A	3
North Terminal departure prior to curbside area	4	4,000	461	0.12	A	4	488	0.12	A	4	537	0.13	A	4	565	0.14	A	4
North Terminal arrival between CV diverge/curbside	4	4,000	536	0.13	A	4	556	0.14	A	4	651	0.16	A	4	700	0.18	A	4
North Terminal GTC between diverge from arrivals road & GTC	2	2,000	204	0.10	A	2	212	0.11	A	2	250	0.12	A	2	273	0.14	A	2

Source: HNTB, June 2016.

5.4.2 Non-Terminal Roadways and Intersections

The following section presents analyses of roadway and intersection capacities for key access facilities located on the perimeter of the Airport.

5.4.2.1 On-Airport Roadways

On-Airport roadway requirements were developed based on current and projected peak or design-hour traffic volumes for individual roadway segments compared to the capacity of each segment. Traffic volumes on West Service Road, where air cargo-related traffic comprises a high share of total traffic, were escalated for future PALs assuming roadway traffic will increase at the same rate as forecast annual cargo tonnage. For John D. Dingell Drive and W. G. Rogell Drive, the projected traffic volumes were assumed to grow at the same rate as the total passenger growth in either the AM or PM peak-hour. Inbound and outbound traffic associated with rental car operations were assumed as the primary share of total traffic on Lucas Drive and the projected traffic volumes were grown relative to the projected increase in originating and terminating passengers.

Similar to the terminal area roadways, lane requirements were developed assuming a target LOS D as shown in Table 5-18. As shown in Table 5-20, the non-terminal roadways should have sufficient capacity to provide an acceptable level-of-service through PAL 3. By PAL 3, eastbound Lucas Drive beginning 400 feet west of Middlebelt Road will be operating at LOS D.

5.4.2.2 Traffic Signals

Capacity and LOS on W. G. Rogell Drive and Burton Drive will be affected by signalized intersections. Using turning movement counts collected during January 2016, the hour experiencing the highest total volume through each intersection was identified. Based on the January 2016 traffic counts, 7:00 p.m. to 8:00 p.m. was identified as the peak hour for this intersection. For both W. G. Rogell Drive and Burton Drive, the volumes were then increased at the same rate as the total passenger growth in origin and destination passengers during the design day AM or PM peak-hour period to establish the volumes associated with the future PALs. For 2016 and each PAL, a planning-level analysis was conducted for the intersection using Synchro traffic analysis software. This method calculates the critical conflicting movements at the intersection to estimate the v/c ratio for the intersection. Using this method, an analyst can identify if and when the activity at the intersection will become sufficient to warrant a capacity increase for the intersection, such as adjustments to geometry or signal cycle timing.

It was determined that the intersection of W. G. Rogell Drive and Burton Drive currently operates with a v/c ratio of 0.59 (LOS C). By PAL 1, the ratio is 0.69 (LOS C) and by PAL 2, the ratio is 0.79 (LOS C), neither of which typically require mitigation. By PAL 3, however, the v/c ratio reaches 0.92 (LOS C), which is sufficiently close to capacity to warrant the consideration of physical and/or operational strategies to increase the capacity of the intersection. It should also be noted that the southbound left turn lane on W. G. Rogell Drive currently operates at LOS F and by PAL 3, the v/c ratio will reach 1.12 should no geometric or operational changes be made to this intersection. The eastbound and westbound through lanes on Burton Drive currently operates at LOS C and will operate at LOS D and LOS E in 2025 and 2035 respectively.

Table 5-20
NON-TERMINAL AREA ROADWAY REQUIREMENTS
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Detroit Metropolitan Wayne County Airport

	Existing Capacity		Baseline (2016)				PAL 1 (2020)				PAL 2 (2025)				PAL 3 (2035)			
Description	Lanes	Capacity (veh/hr)	Demand (veh/hr)	V/C ratio	LOS	Required Lanes	Demand (veh/hr)	V/C ratio	LOS	Required Lanes	Demand (veh/hr)	V/C ratio	LOS	Required Lanes	Demand (veh/hr)	V/C ratio	LOS	Required Lanes
John D. Dingell Drive between Tunnel & Eureka Road (NB)	2	3,200	657	0.21	A	2	758	0.24	A	2	815	0.25	A	2	884	0.28	B	2
John D. Dingell Drive between Tunnel & Eureka Road (SB)	2	3,200	707	0.22	A	2	745	0.23	A	2	839	0.26	B	2	904	0.28	B	2
W. G. Rogell Drive at 1000' N of Burton Drive (SB)	4	6,400	1,820	0.28	B	4	2,099	0.33	B	4	2,257	0.35	B	4	2,449	0.38	B	4
W. G. Rogell Drive at 1150' N of Burton Drive (NB)	3	4,800	1,768	0.37	B	3	1,863	0.39	B	3	2,098	0.44	C	3	2,262	0.47	C	3
Lucas Drive at 150' E of E. Service Drive	1	1,000	410	0.41	B	1	433	0.43	C	1	490	0.49	C	1	536	0.54	C	1
Lucas Drive at 200' E of E. Service Drive	2	2,000	210	0.11	A	2	224	0.11	A	2	249	0.12	A	2	273	0.14	A	2
Lucas Drive at 350' W of Middlebelt Road	1	1,000	491	0.49	C	1	524	0.52	C	1	582	0.58	C	1	637	0.64	D	1
Lucas Drive at 400' W of Middlebelt Road	2	2,000	460	0.23	A	2	486	0.24	A	2	550	0.27	B	2	602	0.30	B	2
W. Service Road at 100' S of Central Maintenance Dw	2	2,000	97	0.05	A	2	116	0.06	A	2	131	0.07	A	2	163	0.08	A	2
W. Service Road at 350' S of Central Maintenance Dw.	1	1,000	52	0.05	A	1	62	0.06	A	1	70	0.07	A	1	87	0.09	A	1
W. G. Rogell NB-SB Crossover at 250' S of Burton Drive	1	1,600	465	0.29	B	1	490	0.31	B	1	552	0.34	B	1	595	0.37	B	1

Source: HNTB, June 2016.

5.4.3 Curbside Facilities

Curbside requirement calculations take into account the physical curb layout (length and number of lanes), the configuration within the network (which influences the presence of vehicles driving through a curb roadway versus stopping to load or unload passengers) and operational practices, including the allocation of space to different vehicle modes and the level of enforcement. Vehicle classifications (e.g., relative proportion of different vehicle modes within the design hour), dwell times for each vehicle mode, and peak-hour traffic volumes along the curbside collected in January 2016 were used to estimate curbside requirements for the Airport.

Table 5-21 presents the observed average peak hour curbside dwell times by vehicle classification. These dwell times are longer than typically observed at similar airports because operational measures are not currently being employed to reduce dwell times for several vehicle classifications. Since dwell times are the main factor driving curb length, and to prevent an overestimation of requirements, it is recommended that an additional set of dwell times – reflecting operations at similar airports that employ enforcement of vehicle loading and unloading – also be used in the estimate of curbside requirements. Table 5-21 presents both the observed and recommended dwell times for comparison.

Table 5-21
AVERAGE PEAK HOUR CURBSIDE DWELL TIMES
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	Existing average dwell times (min)		Recommended average dwell times (min)	
Vehicle classification	McNamara Terminal *(a)*	North Terminal*(b)*	McNamara Terminal	North Terminal
Upper Level – Departures				
Private vehicles	1.7	1.8	1.8	1.8
Taxicab	2.0	3.9	2.0	2.0
Limousine	1.6	5.2	2.0	2.0
Middle Level – Arrivals				
Private vehicles	6.0	5.3	2.5	2.5
Lower Level – International Arrivals				
Private vehicles	2.6	N/A	2.5	N/A
Employee bus	1.8	N/A	1.8	N/A
Ground Transportation Center				
Hotel/motel shuttle	1.8	1.6	1.8	1.8
Off-Airport parking shuttle	1.7	2.7	1.8	1.8
Public transit bus (charter bus)	4.5	9.0	4.5	4.5
Green Lot bus	2.2	5.2	2.2	2.2
Rental car bus	5.6	5.1	2.5	2.5
Inter-terminal shuttle	1.2	3.2	1.2	1.2

(a) McNamara Terminal: Data collected by Advanced Geomatics on January 27-28, 2016 for AM Peak Period of 5:30 a.m. to 8:30 a.m. and PM Peak Period of 6:00 p.m. to 9:00 p.m.
(b) North Terminal: Data collected by Advanced Geomatics on January 25-26, 2016 for AM Peak Period of 5:30 a.m. to 8:30 a.m. and PM Peak Period of 6:00 p.m. to 9:00 p.m.

Source: HNTB, May 2016.

The curbside requirements for 2016 are presented in Tables 5-22 and 5-23 for both the observed and recommended dwell times at both the McNamara and North Terminals. As shown, longer dwell times result in increased curbside requirements. By limiting dwell times along the curbside, the required curb length can be reduced and during alternatives development opportunities for cell phone lots and other measures that may be utilized to manage dwell times will be identified. Curbside requirements were determined based on the following assumptions and guidelines:

- Vehicular fleet mix, dwell times, stand requirements (the length of curb required for a vehicle to stop and load/unload passengers and baggage), and pedestrian activity will remain consistent throughout the planning period.

- Private vehicle curbs assume target of Level of Service C with approximately 40% double parking during peak periods. No double parking is assumed on the commercial vehicle curbs.

5.4.3.1 Curbside Requirements – McNamara Terminal

Table 5-22 summarizes the required curbside length and number of lanes at the McNamara Terminal throughout the planning period depicting the requirements under current operations with existing dwell times and existing and future requirements utilizing the recommended maximum dwell times reflecting active loading and unloading only. The middle level domestic arrivals curbside is currently deficient by 625 feet with observed dwell times; however, with operations limited to active loading only it is estimated that the arrivals level has sufficient length and number of lanes to meet demand through PAL 3. The lower level international arrivals curbside is currently deficient by 630 feet increasing to 760 by PAL 3 while the upper level departures curbside is currently deficient by 15 feet increasing to 115 feet by PAL 3.

As shown in Table 5-22, at the GTC there is currently a 240-foot deficit in curbside length with hotel, parking, and rental car shuttles requiring additional length. With the reduction of rental car dwell times, this deficit is limited to 100 feet increasing to 210 feet by PAL 3 and is primarily associated with the hotel and parking curbside zone. The Authority is currently considering the relocation of rental car operations to a consolidated rental car facility and the impact on curbside requirements will be identified in the alternatives chapter.

5.4.3.2 Curbside Requirements – North Terminal

Table 5-23 summarizes the required curbside length and number of lanes at the North Terminal throughout the planning period. Similar to the requirements for the McNamara Terminal, the North Terminal curbside requirements were estimated for both existing operations with observed dwell times and existing and future requirements utilizing the recommended maximum dwell times reflecting active loading and unloading only. The lower level arrivals curbside is currently deficient by approximately 600 feet with observed dwell times; however, with operations limited to active loading only it is estimated that the arrivals level has sufficient length and number of lanes to meet demand through PAL 1 and will require an additional 100 feet by PAL 3. The upper level departures curbside has sufficient length and number of lanes through PAL 3.

As shown in Table 5-23, at the GTC there is sufficient space to accommodate ground transportation operations through PAL 3, however, a reallocation of space among hotel, parking, and rental car shuttles may be required. Taxicabs are currently located on the fourth floor of the garage and opportunities to co-locate the taxicabs with other ground transportation may be explored during alternatives development. In addition, the Authority is currently considering the relocation of rental car operations to a consolidated rental car facility and as with the McNamara Terminal GTC the impact on curbside requirements will be identified in the alternatives chapter.

Table 5-22
CURBSIDE REQUIREMENTS – McNAMARA TERMINAL
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	Existing supply	Existing operations *(a)*	Estimated requirement *(b)* Baseline (2016)	PAL 1 (2020)	PAL 2 (2025)	PAL 3 (2035)
Upper (departures) level						
Active curbside						
Private vehicle/taxi (feet)	760	725	775	800	800	875
Surplus (deficit) (feet)		35	(15)	(40)	(40)	(115)
Hotel curbside						
Hotel/valet curb (feet)	125	125	125	125	125	125
Shuttle/dedicated area (feet)	100	100	100	100	100	100
Number of lanes	5	5	5	5	5	5
Middle (arrivals) level						
Private vehicle (feet)	950	1,575	725	775	800	850
Surplus (deficit) (feet)		(625)	225	175	150	100
Number of lanes	5	5	5	5	5	5
Lower (international arrivals) level						
Active curbside						
Private vehicle (feet)	240	875	850	925	950	1,000
Surplus (deficit) (feet)		(635)	(610)	(685)	(710)	(760)
Dedicated areas						
Employee parking shuttle (feet)	40	40	40	40	40	40
TSA/CBP spaces (feet)	140	140	140	140	140	140
Number of lanes	5	5	5	5	5	5
Ground Transportation Center						
Taxi (feet)	210	200	200	200	225	225
Hotel/motel shuttle (feet) Off-Airport parking shuttle (feet) Green lot bus (feet)	200	400	440	440	480	480
Public transit/charters (feet)	125	120	120	120	120	120
Rental car shuttle (feet)	325	405	225	225	270	270
Inter-terminal shuttle (feet)	65	40	40	40	40	40
Total curbside length (feet)	925	1,165	1,025	1,025	1,135	1,135
Surplus (deficit) (feet)		(240)	(100)	(100)	(210)	(210)
Number of lanes	4	4	4	4	4	4

Note: Private vehicle curbs assume target of Level of Service C with approximately 40% double parking during peak periods. No double parking is assumed on the commercial vehicle curbs.

(a) Existing operations depict curb length required for 2016 traffic volumes with current enforcement levels and dwell times identified in Table 5-21.

(b) Requirements assume recommended maximum dwell times identified in Table 5-21 reflecting active loading and unloading only Requirements assume recommended maximum dwell times identified in Table 5-21 reflecting active loading and unloading only.

Source: HNTB, May 2016.

Table 5-23
CURBSIDE REQUIREMENTS – NORTH TERMINAL
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			Estimated requirement *(d)*			
	Existing supply	Existing operations *(c)*	Baseline (2016)	PAL 1 (2020)	PAL 2 (2025)	PAL 3 (2035)
Upper (Departures) level						
Private vehicle/taxi (feet) *(a)*	740	500	500	525	600	625
Surplus (deficit) (feet)		240	240	215	140	115
Number of lanes	4	4	4	4	4	4
Middle (Arrivals) level						
Private vehicle (feet)	830	1,425	750	775	875	925
Surplus (deficit) (feet)		(595)	80	55	(45)	(95)
Number of lanes	4	4	4	4	4	4
Ground Transportation Center						
Taxi (feet)	Level 4	--	--	--	--	--
Linear curb						
Hotel/motel shuttle (feet) Off-Airport shuttle (feet)	350	360	320	320	400	400
Rental car shuttle (feet)	500	405	225	225	270	270
Total curbside length (feet)	850	765	545	545	670	670
Surplus (deficit) (feet)		85	305	305	180	180
Pull-in parking spaces						
Public transit (spaces)	2	2	2	2	2	2
Green lot bus (spaces)	4	3	2	2	2	2
Charters (spaces) *(b)*	2	2	2	2	2	2
Inter-terminal shuttle (spaces)	1	1	1	1	1	1
Total number of spaces	9	8	7	7	7	7
Surplus (deficit) spaces		1	2	2	2	2
Number of lanes	3	3	3	3	3	3

Note: Private vehicle curbs assume target of Level of Service C with approximately 40% double parking during peak periods. No double parking is assumed on the commercial vehicle curbs.

(a) 740 feet of the curbside is covered by an overhang from the terminal with an additional 380 feet beyond the terminal for a total of 1,120 linear feet.
(b) No charter buses were recorded during the survey period.
(c) Existing operations depict curb length required for 2016 traffic volumes with current enforcement levels and dwell times identified in Table 5-21.
(d) Requirements assume recommended maximum dwell times identified in Table 5-21 reflecting active loading and unloading only.

Source: HNTB, May 2016.

5.4.4 Parking

Parking demand presented in this section is unconstrained and assumed to grow in existing facilities without regard to individual facility capacity or future development. The unconstrained demand was used to determine at what point each facility will reach capacity without a change to current operations. The demand, along with the assumptions and methodology for both public and employee parking, is summarized below.

5.4.4.1 Public Parking

A parking model was used to calculate future parking space requirements using the passenger forecast, public parking transactions, and overnight and peak hour occupancies for each facility. The model converts transactions to spaces by applying a typical number of turns per space (e.g., how many times the space is used throughout the day) for each parking duration period.* Daily transactions were increased based on the assumptions below to represent future operations for each PAL.

For the McNamara Terminal Garage and the Big Blue Deck, parking demand was assumed to increase proportionally to the forecast growth in O&D passengers at each associated terminal. Parking demand at the Green Lots was assumed to increase proportionally to the forecast growth in the overall Airport O&D passengers. It was further assumed that there would be no significant change in travel mode choice (e.g., passengers using on-Airport public parking facilities would continue to do so in the future).

The requirement for on-Airport public parking is 17,260 spaces increasing to 21,722 spaces by PAL 3, which represents a 26% increase in overall demand through the planning period.

As is typical in the industry, a search factor was applied to the demand for each facility to calculate the actual number of spaces required including a surplus that will allow vehicles entering the facility to find an open parking space within a reasonable amount of time. A factor of 5%** was applied to all public parking facilities to represent the degree of difficulty for finding an open space in a large multi-level facility.

Table 5-24 summarizes public parking requirements relative to the existing parking facility capacity. Airport parking requirements will exceed the overall Airport parking supply by 1,646 public parking spaces by PAL 1 and 2,374 public parking spaces by PAL 2 if no new facilities are brought in to service. The McNamara Terminal Garage currently operates at capacity during peak periods, and by PAL 2 without changes to current operations, the McNamara Terminal Garage is expected to need an additional 1,320 public parking spaces to accommodate the growth in public demand. With no new facilities, the overall parking deficit will reach 3,554 spaces by PAL 3.

5.4.4.2 Employee Parking

The current permit to occupied parking space ratio (during shift change) and estimated growth in employee parking permits were used to estimate future employee parking requirements. Requirements are estimated for shift-changes to reflect the overlap needed to accommodate employees who must start their shift before the employees they are reliving end their shift. Future issued employee parking permits were estimated based on the forecast growth in total passengers for each PAL.

*For instance, a space that is occupied for less than two hours will be used more frequently throughout the day than a space occupied by a passenger who is parked for a two day trip. The space occupied by the two-day parkers will only be turned over once every two days while the space occupied by a two hour parker may be used up to six times a day.

**Historically a 10% factor was applied; however, technology enhancements are now radially available to increase the efficiency and utilization of the facilities by guiding parkers to open spaces. These enhancements are also less expensive than constructing new structured parking.

Table 5-24
PARKING SPACE REQUIREMENTS
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	Existing Supply	Estimated requirement Baseline (2016)	PAL 1 (2020)	PAL 2 (2025)	PAL 3 (2035)
Public Parking *(a)*					
McNamara					
Short-term	723	645	678	696	775
Long-term	8,690	9,300	9,771	10,037	11,175
Total	9,413	9,945	10,449	10,733	11,950
Surplus (Deficit)		(532)	(1,036)	(1,320)	(2,537)
Big Blue Deck					
Short-term	203	123	132	149	164
Long-term	5,958	6,347	6,835	7,702	8,497
Total	6,161	6,469	6,967	7,851	8,661
Surplus (Deficit)		(308)	(806)	(1,690)	(2,500)
Green Lots					
Green Lot 1	1,517	1,268	1,352	1,479	1,631
Green Lot 2	896	440	468	512	565
Total	2,413	1,708	1,820	1,991	2,197
Surplus (Deficit)		705	593	422	216
Employee Parking					
South Lot	4,500	3,375	3,646	3,891	4,381
Surplus (Deficit)		1,125	854	609	119
McNamara Garage	780	741	800	854	961
Surplus (Deficit)		39	(20)	(74)	(181)
Big Blue Deck	440	440	476	508	573
Surplus (Deficit)		--	(36)	(68)	(133)
Smith Terminal	392	392	423	452	509
Surplus (Deficit)		--	(31)	(60)	(117)

(a) Assumes 5% surplus over demand to account for vehicles searching for parking spaces.

Source: HNTB, May 2016.

Total passenger growth was used because Airport employees serve both O&D and connecting passengers who use the Airport facilities such as concessions and post-security locations. Similar to the calculation of public parking requirements, the individual terminal passenger growth rates were used to calculate demand for the McNamara Terminal Garage and the Big Blue Deck and an overall Airport passenger growth rate was used for the South Lot and the Smith Terminal parking area. The employee parking space requirements are shown in Table 5-24. The requirement is assumed to grow unconstrained within each facility. Employee parking space requirements are projected to increase by approximately 30% between 2016 and 2035.

At present, the employee parking shuttles run between the South Lot and both terminals. It takes approximately six minutes and eight minutes for the shuttles to travel from the parking lot to the McNamara and North Terminals respectively. It takes approximately 23 minutes for the shuttles to travel from the South Lot to the North and McNamara Terminals in a loop operation with a stop at each terminal.

5.4.5 Rental Car facilities

Requirements for rental car facilities are based on (1) existing activity of the rental car operators currently serving the Airport, (2) survey responses from individual rental car companies describing spatial and functional needs, (3) industry standards for rental car operations; and (4) assumptions regarding the future configuration of the rental car facilities. Requirements for future PALs are based on the projected growth of the total O&D passengers.

Table 5-25 summarizes the rental car requirements for the major functional areas, which include:

- **Customer Service / Employee Areas** – These areas are comprised of the customer service counters and lobby along with employee offices, administrative space, break-rooms and employee and visitor parking.
- **Ready-Return Area** – The area where customers pick and return vehicles. Area requirements assume ready spaces are configured as traditional parking spaces while return spaces are nose-to-tail.
- **Service Areas** – These areas are where vehicles are fueled and washed between rentals. Light maintenance, such as oil changes and tire rotations are also performed here. The space requirements for stacking, staging, and storage assume a nose-to-tail configuration and are based on needs indicated by the rental car companies. A more efficient service area or quick-turn-around layout may allow a more compact footprint.
- **Additional Service Areas/Circulation** – This area accounts for circulation throughout the site along with areas that each rental car company currently uses for functions such as receiving vehicles and holding vehicles while completing registration paperwork.

As shown, it is estimated that ready-return facilities are assumed to operate in an unconstrained manner and sufficient storage is provided as requested by the rental car companies. The requirements assume independent operations; however, a consolidated rental car facility might have operational efficiencies that would reduce the required space. To meet current needs with efficient space layouts the rental car sites currently require approximately 64.9 acres, including 5.4 acres (including 565 employee/visitor parking spaces) for customer facilities, 19.4 acres for ready/return operations (including 1,437 ready parking spaces and 1,838 return parking spaces), and 22 acres for support service facilities. By PAL 3, rental car facilities will require approximately 103.3 acres, including 7.9 acres (including 841 employee/visitor parking spaces) for customer facilities, 37.3 acres for ready/return operations (including 2,826 ready parking spaces and 3,428 return parking spaces), and 35.3 acres for support service facilities.

Table 5-25
RENTAL CAR REQUIREMENTS
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	Existing Supply	Estimated requirements Baseline (2016)	PAL 1	PAL 2	PAL 3
Customer service / employee areas					
Employee / visitor parking spaces (stalls)	565	664	706	768	841
Employee / visitor parking area (acres)	4.2	4.9	5.2	5.6	6.2
Customer service area / administrative offices (acres)	1.3	1.3	1.4	1.5	1.7
Total customer service / employee area	5.4	6.2	6.6	7.2	7.9
Ready/return area					
Ready parking spaces (stalls)	1,437	2,230	2,373	2,578	2,826
Return parking spaces (nose-to-tail) stalls	1,838	2,705	2,878	3,127	3,428
Total ready-return area (acres)	19.4	29.4	31.3	34.0	37.3
Service areas					
Fueling and washing (acres)	1.9	2.7	2.9	3.1	3.4
Maintenance (acres)	1.3	2.0	2.1	2.3	2.6
Stacking, staging, and storage (acres)	18.7	23.1	24.6	26.7	29.3
Total service area (acres)	22.0	27.8	29.6	32.2	35.3
Additional service areas/circulation (acres)	18.0	18.0	19.2	20.8	22.8
Total site (acres)	64.9	81.5	86.7	94.2	103.3
Surplus (deficit) acres		(16.6)	(21.8)	(29.3)	(38.4)

Source: HNTB, based on survey data from individual rental car companies, May 2016.

5.5 AIR CARGO AND GENERAL AVIATION

The following summarizes estimated requirements for the Airport's air cargo and general aviation facilities. Requirements were developed based on collected inventory data, anecdotal information from Authority staff and stakeholders, surveys/questionnaires distributed to Airport tenants, and industry standards.

5.5.1 Air Cargo

Air cargo tenants include: United Parcel Service (UPS), Delta Cargo, FedEx, DHL Express, Southwest Airlines Cargo, and Air General Inc. Table 5-26 summarizes existing air cargo facilities by type of cargo transported.* Survey responses from tenants indicated the following facility needs and constraints:

- Delta Cargo is currently constrained by the number of loading docks available to its main facility (Building 536). Expansion plans are available through its leasehold.

*Air cargo can be separated into two main categories: all-cargo and belly cargo. All-cargo refers to air cargo that is transported by carriers that exclusively transport cargo. Belly cargo refers to cargo that is transported under the main deck of an airplane by commercial air carriers.

- FedEx's facilities are expected to be adequate based on anticipated fleet mix changes, although four aircraft parking positions are required.
- DHL Express is currently constrained by lack of space at its facility and has expressed a need for docks with high access/container handling, cross docking, equipment storage, an office area, and ground pick-up/delivery.
- Air General reported constrained operations in the Combined Use Air Cargo Building due to a lack of warehouse space, and expressed a need for an aircraft parking position adjacent to the facility.
- UPS expressed the need for expansion of the apron taxiway entrance to allow for additional aircraft parking.
- Consideration should be given to a multi-tenant/master cargo facility located away from the Airport's primary vehicle access roadways.

5.5.1.1 Air Cargo Warehouse Requirements

Requirements for air cargo warehouse space were evaluated for both all-cargo and belly cargo using two methods. One method assessed requirements based on 2015 space-tonnage utilizations, which were 0.95 tons per square-foot of building space for all-cargo/integrated carrier operations and a ratio of 0.93 tons per square-foot for belly cargo operations. The other method utilized an industry standard ratio of 1.5 tons per square-foot for integrated carrier facilities, and 1.0 ton per square-foot for belly cargo facilities. Table 5-27 summarizes the future requirements based on averages of the two methodologies. As presented, the amount of integrated carrier warehouse space is generally sufficient to accommodate demand throughout the planning period; additional space for belly cargo will be required in the near-term and throughout the planning period.

Table 5-26
EXISTING AIR CARGO WAREHOUSE FACILITIES
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Building	Tenant/user	Building gross SF
Integrated carriers		
427	UPS	15,657
723	FedEx	62,600
714	FedEx (vehicle maintenance)	8,400
714A	DHL Express	30,566
	Total	117,223
Belly cargo		
536	Delta Cargo	15,632
536A	Delta Air Freight	20,700
514	Delta Cargo/Swissport	53,450
614	Southwest Cargo/Air General	20,029
	Total	109,811

Source: Fixed Assets Database, Detroit Metropolitan Wayne County Airport Authority, February 2016.

Table 5-27
AIR CARGO WAREHOUSE REQUIREMENTS
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	Integrated carriers			Belly cargo		
	Existing tons/SF ratio (.95)	Industry ratio 1.5 tons/1.0 SF	Average	Existing tons/SF ratio (.95)	Industry ratio 1.5 tons/1.0 SF	Average
PAL 1	123,252	78,059	100,656	129,222	120,176	124,699
PAL 2	129,519	82,029	105,774	144,633	134,509	139,571
PAL 3	143,214	90,702	116,958	177,828	165,380	171,604

Source: C&S Engineers, May 2016.

5.5.1.2 *Air Cargo Apron Requirements*

As presented in Table 5-28, the Airport includes approximately 586,800 square-feet of apron space dedicated to air-cargo operations and facilities.

Table 5-28
EXISTING AIR CARGO APRON FACILITIES
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Building	Facility	Area (SF)
714A	DHL Express	83,500
427	UPS	172,800
723	FedEx	330,500
Total		586,800

Source: Fixed Assets Database, Detroit Metropolitan Wayne County Airport Authority.

Requirements for air cargo apron were also evaluated using two methods – 2015 apron-tonnage utilizations (0.94 tons per square-foot of apron), and an industry average ratio of 1.5 tons per square-foot of apron. Table 5-29 summarizes the future requirements and averages of the two methodologies. As presented, the total existing amount of air cargo apron is sufficient to meet forecast air cargo demand throughout the planning period. However, operational factors related to a specific operator can be more or less than the industry standards. Several air cargo tenants indicated the need for additional ramp space or taxiway entrance modifications. In addition to these considerations, potential changes in aircraft fleet mix should also be considered.*

*ACRP Report 96, *Apron Planning and Design Guidebook*, Transportation Research Board and sponsored by the FAA, published 2013, Pg. 129. Accessible at: http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_096.pdf.

Table 5-29
AIR CARGO APRON REQUIREMENTS
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	All-cargo		
	Existing tons/SF ratio (.95)	Industry ratio 1.5 tons/1.0 SF	Average
PAL 1	616,980	390,751	503,866
PAL 2	648,352	410,624	529,488
PAL 3	716,907	454,040	585,473

5.5.2 General Aviation

General aviation accounted for 1.5% of total aircraft operations in 2015. Throughout the 20-year planning period, general aviation activity is forecast to remain relatively consistent, with aircraft operations decreasing to 1.3% of total Airport operations by the end of the planning period. There are currently 11 facilities located on the Airport associated with general aviation, which account for approximately 422,900 square feet of space. Some facilities are currently vacant and/or available for reuse.

Based on consistent general aviation activity throughout the planning period, existing general aviation hangar space and apron area is assumed to be sufficient throughout the 20-year planning period, although replacement, reuse, or rehabilitation will occur to some of the facilities during this time.

5.6 AIRPORT MAINTENANCE COMPLEX

A conditions assessment and analysis of the Airport's Maintenance Complex identified areas of the campus that will require future expansion, upgrade, or replacement to meet future Airport maintenance needs. The assessment indicates that a number of the maintenance facility's components will need to be expanded or replaced to ensure that the facility is adequate throughout the 20-year program period.

The most significant deficiencies in the Airport's maintenance facility were identified in the Fleet Inventory Logistic Center, Fleet Services Maintenance, and Fleet Vehicle Storage. A total of approximately 37,300 square feet of future additional building area are required. Less significant deficiencies were in maintenance offices and building support facilities, requiring an additional building area of approximately 9,000 square feet. Alternatives that meet the facility deficiencies are reviewed in the alternatives analysis.

In addition, a new maintenance satellite breakroom building is required on the southeast end of the Airport campus to increase operational efficiencies of field maintenance and airfield operations during snow removal and emergency procedures. This facility should be approximately 2,000 square feet and will include a large breakroom, men's and women's restrooms, and support spaces. A pneumatic air pump will be provided on the exterior of the building for vehicle use. An equipment parking area will be appropriately sized based on discussions with maintenance stakeholders during the alternative development phase.

Overall, the required increase in the maintenance facilities area, including the new maintenance satellite breakroom building totals approximately 48,000 square feet (an increase of approximately 23% from existing area). A summary of the total maintenance facilities square foot area requirements is provided in Table 5-30.

Table 5-30
AIRPORT MAINTENANCE COMPLEX REQUIREMENTS (SF)
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Detroit Metropolitan Wayne County Airport

Facility	Existing area	Deficit	Total maintenance facility requirements	Comments
Maintenance Campus				
Administration offices	6,600	900	7,500	
Conference/meeting rooms	600	1,500	2,100	Conference space for up to 90 people
Restrooms	2,400	500	2,900	
Mens locker room	1,900	1,000	2,900	
Womens locker room	200	0	200	
Breakrooms with recreation	2,100	700	2,800	Includes centralized fitness area for staff
Training & learning center	1,300	600	1,900	
Inventory logistics center	15,100	5,400	20,500	
Skilled trades	9,400	0	9,400	Carpentry, plumbing, key shop, recycle
Sign studio	1,300	1,600	2,900	
HVAC shop	1,700	0	1,700	
Electrical shop	6,300	0	6,300	
Paint shop	1,800	900	2,600	
Fleet services maintenance	20,200	13,700	33,800	
Fleet vehicle storage	133,800	22,300	156,100	Total for buildings 705 and 711 indoor storage; includes new 4,000 SF wash bay
Support/circulation	13,800	1,800	15,600	
Satellite breakroom building	0	2,000	2,000	New building with parking for 30 vehicles
Total building area	**218,500**	**52,900**	**271,200**	
Employee vehicle parking	268	134	402	Parking spaces. Increase 50%
Total parking area	**75,040**	**37,520**	**112,560**	280 SF/space (9'x18' parking space & 1/2 driving aisle)

Source: HNTB, July 2016.

Chapter 6
ALTERNATIVES DEVELOPMENT AND EVALUATION

This chapter summarizes the approach, development of concept alternatives, identification of evaluation criteria, and selection of preferred alternatives for the Recommended Development Plan (RDP). Concept alternatives were developed for the airfield, passenger terminal complex, ground access and parking, air cargo and aviation support facilities based on assessments of existing capacity and future demand for major aviation-related facilities. This chapter is organized as follows:

- Airfield Alternatives
- Ground Transportation and Parking Alternatives
- Airport Maintenance Complex Alternatives
- Other Development Alternatives Considered

Master plan project phasing, implementation, and financial feasibility is summarized in Chapters 7 and 8.

Concept alternatives were formulated to meet the requirements associated with the forecast aviation demand at the Airport, as documented in Chapter 5, Facility Requirements. Alternatives for each major component of the Master Plan were developed and refined through a series of interactive workshops, independent work sessions, and stakeholder meetings during which Authority staff and stakeholders collaborated on planning options, challenges, and provided real-time feedback to the Consultant Team. Some of the major interactive workshops, stakeholder meetings, and work sessions included:

- **Collaborative small group work sessions** – addressing technical viabilities for rental car sites, parking and ground access options, maintenance facility locations, ramp/snow removal facilities, and security screening were conducted.
- **Technical subcommittee meetings** – over 20 subcommittee meetings were conducted covering specialized subject areas including remote aircraft operations, taxiway/runway safety, discussions with air traffic control tower staff, Airport operations, TSA, CBP, airlines, and other stakeholder groups.
- **Technical Advisory Committee (TAC) meetings** – three meetings were conducted to obtain feedback and evaluations from a selected list of technical stakeholder groups.
- **Community Advisory Committee (CAC) meetings** – three meetings were conducted to obtain feedback and evaluations from a selected group of community organizations.
- **FAA Airport District Office (ADO) meetings** – numerous collaboration meetings were conducted with the local FAA ADO to work out goals, objectives, and expectations of the Master Plan Airport Layout Plan set / Exhibit A deliverables for a more streamlined FAA review process.
- **Public Information Meetings** – three meetings were conducted to convey master plan milestones (i.e., project kick-off, alternatives development, and recommended development plan) and obtain feedback from the general public. These meetings resulted in valuable feedback that informed Project Steering Committee decisions.
- **Project Steering Committee (PSC) meetings** – three meetings were conducted involving senior Airport executives as the decision-making body to approve preferred alternatives as recommended by the master planning team.

Feedback from the above collaborative workshops and meetings were taken into consideration and comments incorporated into the refined concept alternatives, where evaluation criteria were identified for use toward screening down to a preferred alternative.

6.1 AIRFIELD ALTERNATIVES

The Airport has sufficient airfield capacity to accommodate forecast demand throughout the twenty-year planning horizon, as documented in Chapter 5. As a result, a key focus of the alternatives analysis was to enhance the safety of the airfield by meeting current FAA design standards and incorporating facility recommendations from the FAA's Runway Incursion Mitigation (RIM) program.

The FAA's Airport and Airspace Delay Simulation Model (SIMMOD)—a fast-time airfield and airspace simulation model—was used to both formulate and evaluate certain airfield alternatives considered in the following sections. Simulation modeling was undertaken in coordination with Authority staff, FAA air traffic organizations (i.e., Detroit ATCT and TRACON) and Airport users/tenants. The simulation provides two important benefits: (1) the ability to review animations of the airfield, which quickly reveal congestion points in the current condition or in future scenarios, and (2) the ability to review extensive data on travel times and delay for both existing and future conditions. The simulation allowed the consideration of many "what if" scenarios.

Airfield simulations were run for both north flow (landings and take-offs to the north) and south flow. Simulations were also run for the normal operating condition and for the condition when deicing is taking place. More than 20 distinct simulations were run for the airfield alternatives analyses. Since deicing was a major focus of the airfield, the majority of simulations concentrated on deicing, but the normal airfield operating condition was also simulated to test various airfield enhancements.

The following describes examples of the manner in which simulation was used for this analysis:

- Several taxiway extensions were found to provide benefit in reducing travel and delay times, but the benefits were not great enough to justify the capital expenditure at this time, and thus the improvements were not included as proposed projects.

- The initial layout of a facility such as a modified deicing pad was revealed to contribute to congestion issues under high traffic volumes and the pad layout was thereby modified.

- Airfield facilities, such as a connecting taxiway, that do not meet current design criteria (including RIM) were evaluated to consider how they contribute to airfield efficiency. In some cases, it was found that a facility could be removed to meet new standards without affecting capacity. In other cases, the facility was moved in order to meet new standards and also maintain or improve efficiency.

6.1.1 Runway 3L-21R Reconstruction

Runway 3L-21R, one of the Airport's two primary departure runways, has reached the end of its service life and is in need of near-term reconstruction. The runway is currently 200 feet wide and 8,501 feet long and has design features that do not meet current FAA design standards, such as a lack of paved shoulders and visual screen for aircraft taxiing on Taxiways J and T, which cross the extended runway centerline. The runway must meet FAA minimum design standards to meet FAA-eligibility for federal funding for reconstruction. The standard runway width for the future use of Runway 3L-21R is 150 feet, and any runway width greater than the standard is not eligible for FAA funding. Also as documented in Chapter 5, the current 8,501-foot runway length is adequate to serve the existing and forecast fleet mix, and therefore, a runway extension is not necessary.

During preliminary consideration of Runway 3L-21R reconstruction options, the following were identified as penetrations to the Runway 21R 40:1 TERPS Instrument Departure Surface (Departure Surface): McNamara Terminal parking structure; Boeing 747-400 and other Group V aircraft tails on Taxiways J and T; and Group III aircraft tails on Taxiway PP. The current definition of the Departure Surface was developed in 2004 and begins at the elevation of the stop end of the runway endpoint and rises at a 40:1 slope. Prior to 2004, the Departure Surface began at 35 feet above the stop end of runway endpoint and continued to rise at a 40:1 slope. The McNamara Terminal Parking Structure opened in 2002, under the guidance of the previous Departure Surface, and does not penetrate that Departure Surface. The FAA Office of Airports currently has a Letter of Agreement (LOA) with the Authority to apply “Departure Credits” that enable the Departure Surface to begin 35 feet above the stop end of runway endpoint (per the previous definition) for Runways 3L, 21R, 27R, and 22L. The 35-foot Departure Credit enables each of the aforementioned objects to be clear of the Departure Surface.

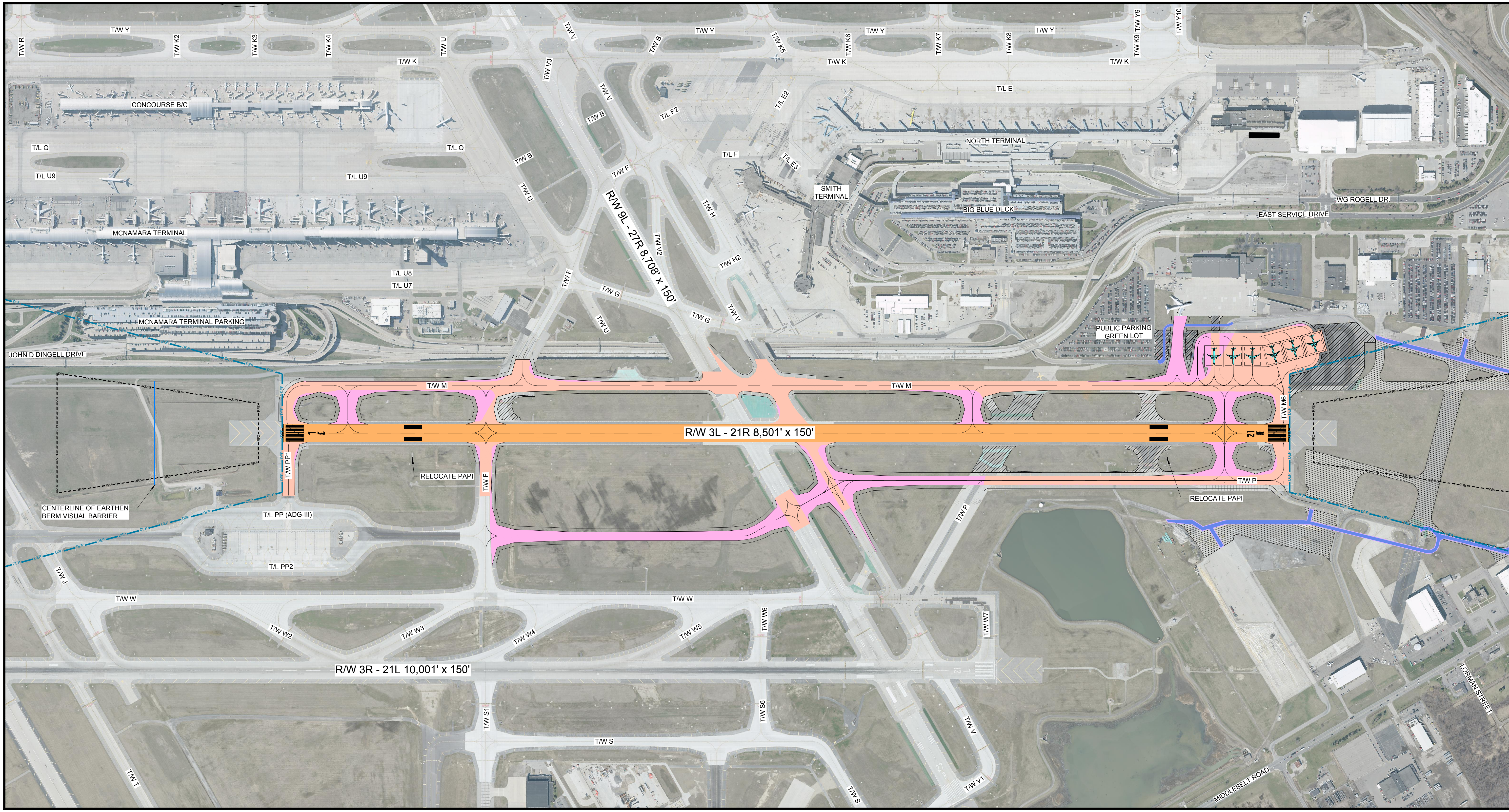
Runway 3L-21R is currently a visual runway and the only of the four parallel north-south runways that does not have either precision instrument or non-precision instrument procedures to accommodate arriving aircraft. During snow events where one of the arrival runways is temporarily closed for snow removal, it would be beneficial to have a non-precision instrument procedure for Runway 3L-21R to maintain arrival flow capacity. A non-precision RNAV (GPS) instrument procedure would not require any additional ground-based navigational equipment, and could be achieved by requesting FAA Flight Procedures to develop such a procedure. In order to minimize impacts to RPZs, a non-precision instrument approach would need to be limited to an approach visibility minimum of 1 mile. Any less, which a GPS-procedure is capable of achieving, would increase the size of the RPZ and potentially require other Airport facilities to be relocated. Further, although some older aircraft are not equipped to fly RNAV approaches, virtually all air carrier aircraft will be capable in the near future.

In addition to establishing a non-precision instrument procedure, other recommended facility improvements associated with the runway reconstruction include: extending Taxiway P to allow for enhanced efficiency of aircraft coming out of the Runway 3L deicing pad; maintaining the alignment of parallel Taxiway M; and improving the efficiency of and meeting design standards for deicing pads adjacent to Runway 3L-21 and the 21R deicing pad.

The possibility of relocating Runway 3L-21R to the east in order to protect against the possibility that the existing Departure Credits would be rescinded by FAA was considered in the alternatives analysis. Over 25 variations of potential future runway alignments were considered, with the following two options analyzed in detail:

1. Alternative 1 – Maintain existing Runway 3L-21R centerline and reconstruct the runway to a width of 150 feet (see Figure 6-1).
2. Alternative 2 – Shift Runway 3L-21R centerline 110 feet to the east and reconstruct the runway to a width of 150 feet (see Figure 6-2).

A summary of Alternatives 1 and 2 is included in Table 6-1, and a detailed description of both alternatives is provided in the following sections.



LEGEND

	Future runway pavement
	Future taxiway/apron pavement
	Reconstruct taxiway/apron pavement
	Centerline of earthen berm visual barrier
	Building/pavement removal
	Precision approach path indicator (PAPI)
	Future roadway
R/W	Runway
T/L	Taxilane
T/W	Taxiway

NORTH

0 400' 800' 1600'

Figure 6-1

RUNWAY 3L-21R RELOCATION ALTERNATIVE 1 – MAINTAIN EXISTING CENTERLINE

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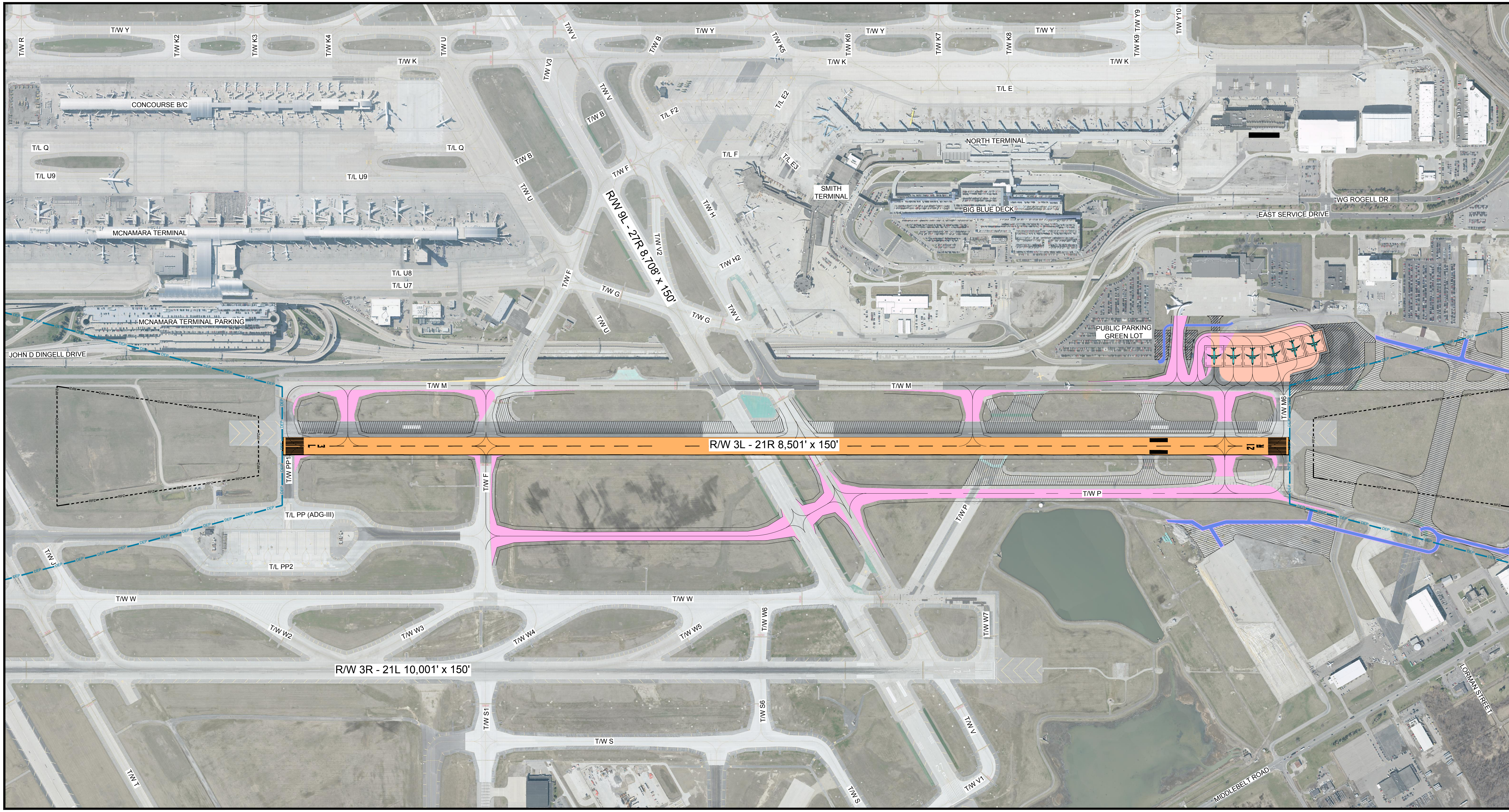

LEGEND

Future runway pavement	Building/pavement removal
Future taxiway/apron pavement	Precision approach path indicator (PAPI)
Reconstruct taxiway/apron pavement	Future roadway
Centerline of earthen berm visual barrier	R/W Runway
	T/L Taxilane
	T/W Taxiway

NORTH

0 400' 800' 1600'

Figure 6-2
RUNWAY 3L-21R RELOCATION ALTERNATIVE 2 – OFFSET EXISTING CENTERLINE 110 FEET EAST

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Table 6-1
RUNWAY 3L-21R RECONSTRUCTION ALTERNATIVE ALIGNMENT SUMMARY
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	Existing	Alternative 1: Maintain Existing Runway C/L	Alternative 2: Shift Runway C/L to the East
Dimensions (W x L)	200' x 8,501'	150' x 8,501'	150' x 8,501'
Shoulder width	0'	35'	35'
Runways 3L-21R to 3R-21L separation	2,000'	2,000'	1,890'
Taxiway M to runway separation	400'	400'	510'
Taxiway P to runway separation	400'	400'	400'
Taxiway PP to runway separation	680'	680'	570'
Approach visibility minimum	3 miles (Visual)	1 mile (GPS)	1 mile (GPS)
Visual NAVAIDs	HIRL, PAPI	HIRL, PAPI	HIRL, PAPI
Markings	Non-precision	Non-precision	Non-Precision
RPZ Size (w_1 x w_2 x L)	500' x 1,010' x 1,700'	500' x 1,010' x 1,700'	500' x 1,010' x 1,700'

Source: HNTB, August 2016.

6.1.1.1 Alternative 1: Maintain Existing Runway Centerline

Alternative 1 maintains the existing centerline of Runway 3L-21R and applies the FAA Departure Credits to ensure aircraft tails are clear of the Departure Surface. It also includes a reconfiguration and reconstruction of the Runway 21R deicing pad to eliminate aircraft tail penetrations to the Runway 3L Departure Surface when aircraft exit the three most northern positions of the pad. Without the reconfiguration, the aircraft using the pad will penetrate the TERPS departure surface even after the application of the Departure Credits. The runway/taxiway connectors would be reconstructed and reconfigured in both options to enable more efficient aircraft movements and enhanced departure sequencing by including a bypass taxiway less than 500 feet from each end of the runway. Alternative 1 also includes an extension of Taxiway P across runway 9L-27R to reduce crossings of Runway 3L-21R and taxi distance. A Modification of Airport Design Standards (MOS) would be filed with the FAA Office of Airports to formally adopt the Departure Credits for this runway. This alternative also includes a visual screen needed to meet end-around-taxiway design standards. The estimated rough order of magnitude (ROM) cost for this alternative is $215 million.

6.1.1.2 Alternative 2: Shift Runway Centerline to the East

Alternative 2 shifts the centerline of Runway 3L-21R by 110 feet to the east to remove the McNamara Terminal Parking Structure as a fixed obstruction from the Runway 21R Departure Surface. It also includes a reconfiguration and reconstruction of the Runway 21R deicing pad to eliminate aircraft tail penetrations to the Runway 3L Departure Surface when aircraft exit the three most northern positions of the pad. Without the reconfiguration, the aircraft using the pad will penetrate the TERPS departure surface. The 110-foot shift still allows for simultaneous departures and arrivals on Runways 21L and 21R, respectively (the maximum allowable shift to maintain simultaneous departures and arrivals is 150 feet). This alternative requires the reconstruction and relocation of Taxiway P by 110 feet to the east in order to meet minimum design standards separation. Similar to Alternative 1, it proposes that Taxiway P would be extended across Runway 9L-27R. However, it results in Departure Surface penetrations to the tails of taxiing aircraft on Taxiways J, T, and PP. Alternative 2 protects against the possibility of the cancelling of the existing Departure Credits and future McNamara Parking Structure expansion. This alternative also includes a visual screen needed to meet end-around-taxiway design standards. The estimated rough order of magnitude (ROM) cost for this alternative is $265 million.

6.1.1.3 Evaluation of Runway 3L-21R Alternatives

Both alternatives were reviewed extensively by the Authority, TAC stakeholder groups, and the FAA and screened based on six criteria. Table 6-2 compares the two alternatives under six different metrics. Scoring is based on Negative (-), Neutral (0), and Positive (+) for each criterion. The higher the positive score, the greater an alternative performs against the evaluation criteria.

Alternative 1 more closely meets the criteria established by the TAC. The variance in cost and constructability between the two alternatives heavily influences the merits of Alternative 1.

Table 6-2
RUNWAY 3L-21R RECONSTRUCTION EVALUATION MATRIX
Airport Master Plan Update
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Evaluation Criteria	Alternative 1: Maintain Existing Runway C/L	Alternative 2: Shift Runway C/L to the East
Minimizes cost / constructible	+	-
Enhances operational flexibility / efficiency	+	+
Preserves / enhances capacity	+	+
Compatible with future land uses	+	+
Addresses FAA design standards	+	+
Environmental impact (during construction)	0	-
Total score	5	2

Source: HNTB, August 2016.

6.1.2 Deicing Pads and RON Parking Facilities

Other facilities evaluated for standards compliance, capacity, and efficiency are the deicing pads and RON aircraft parking positions. The existing utilization strategies for deicing at the Airport does not provide for common use deicing. Of the four existing deicing pads, two are dedicated to Delta Air Lines (Runway 4R pad and Runway 3L pad), one is dedicated to Delta Connection (Runway 22L pad), and one is dedicated to the airlines operating from the North Terminal (Runway 21R pad). The requirements evaluation indicated the need for additional deicing positions and, while not a hard-fast requirement, the Airport could benefit from two additional widebody deicing positions (one for Delta Air Lines and its alliance partners, and one for North Terminal carriers). Further, the requirements evaluation indicated that one position would be lost at each deicing pad when the Airport meets current deicing pad design standards.

From a pavement perspective, the existing deicing pads are in good condition, with the exception of the Runway 21R pad, which has reached the end of its useful life. FAA design standards must be met when pavement reconstruction is needed for taxiways, runways, and aprons.

Prior to the development of potential concepts for deicing pad improvements, the following recommendation were provided by the TAC stakeholders groups and FAA regarding future deicing pads:

- Given the limited space available for a centralized deicing pad and the number of peak aircraft departures, it is not feasible to develop a single deicing pad to serve all aircraft simultaneously while providing the required level of service.
- Any pads undergoing reconstruction, reconfiguration, or greenfield pads must meet current FAA design standards.
- The evaluation should consider whether the existing deicing pads would be more efficiently utilized if common-use strategies were applied.
- Propose a reconfiguration of the 22L pad to meet standards. This pad is currently substandard and could benefit from a reconfiguration to improve neighboring substandard geometry.
- Improve widebody deicing capability for North Terminal carriers and Delta Air Lines (and partners).

6.1.2.1 Runway 22L Deicing Pad

The Runway 22L deicing pad currently accommodates 10 Delta Connection positions that can service up to Embraer 175-sized aircraft. The pad does not have standard vehicle maneuvering areas and vehicle safety zones. The Design Day Flight Schedules (DDFS) associated with the activity forecast show that the physical aircraft size of the Delta Connection fleet is increasing throughout the planning period. With a drawdown of sub-70 seat aircraft, the future Delta Connection fleet will rely on larger aircraft with increasing wingspans and lengths that approach those of mainline narrowbody aircraft. Therefore, all concepts for the Runway 22L deicing pad will be planned to large regional jet standards (e.g., Embraer 195 aircraft).

The location of the Runway 22L deicing pad would also require a westward shift in the centerline geometry of Taxiway K in order to maintain TOFA clearance to the deicing pad. As a result, the centerline-to-centerline separation between Taxiways K and Y converges from the standard ADG V separation of 267 feet to 227 feet between Taxiways K6 and Taxiway U. This substandard separation restricts the capability of that section of Taxiways Y and K from being able to accommodate simultaneous ADG V aircraft. Given that Runway 4R-22L is the primary departure runway for widebody aircraft, it is important for ATC to have flexibility in taxi routings, and the existing geometry limits flexibility.

The Runway 22L deicing pad is constrained by the now-vacant Smith Terminal, taxiways, and the North Terminal. The Authority has identified near-term plans to demolish the Smith Terminal, which will provide additional area to meet current design standards. Given the need for a widebody deicing position for North Terminal carriers, this site also has the potential to accommodate that need as it is close to the North Terminal. Demolition of the Smith Terminal could also provide additional RON parking positions.

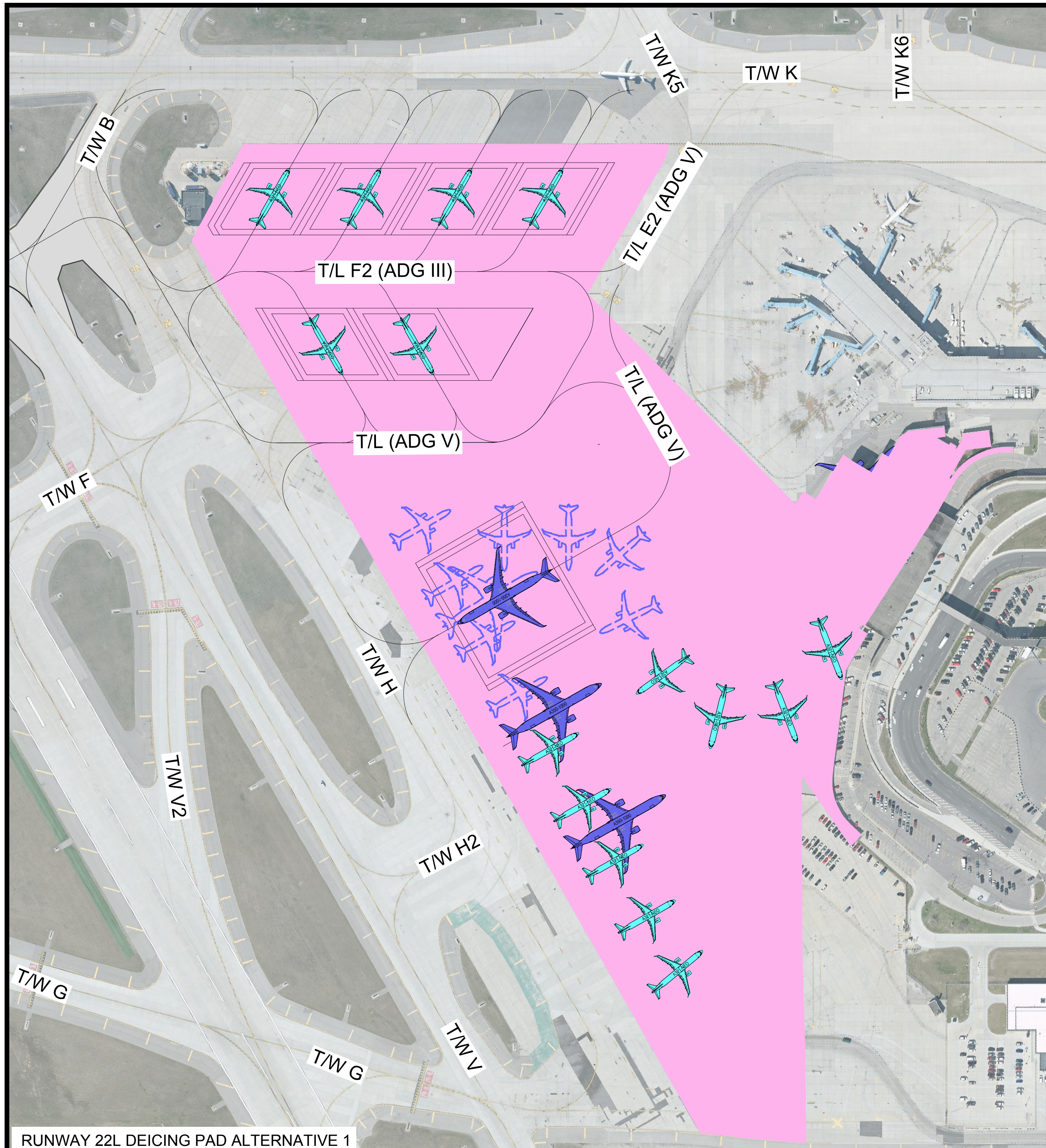
A series of preliminary concepts for the Runway 22L deicing pad were developed and reviewed by TAC technical stakeholders groups and the FAA. The concepts were intended to show ranges of activity for the 22L pad for both deicing and RON. Key considerations in developing the concepts were to improve access into and out of positions, provide additional aircraft queuing area, and meet new design standards. Numerous alternatives were considered, including:

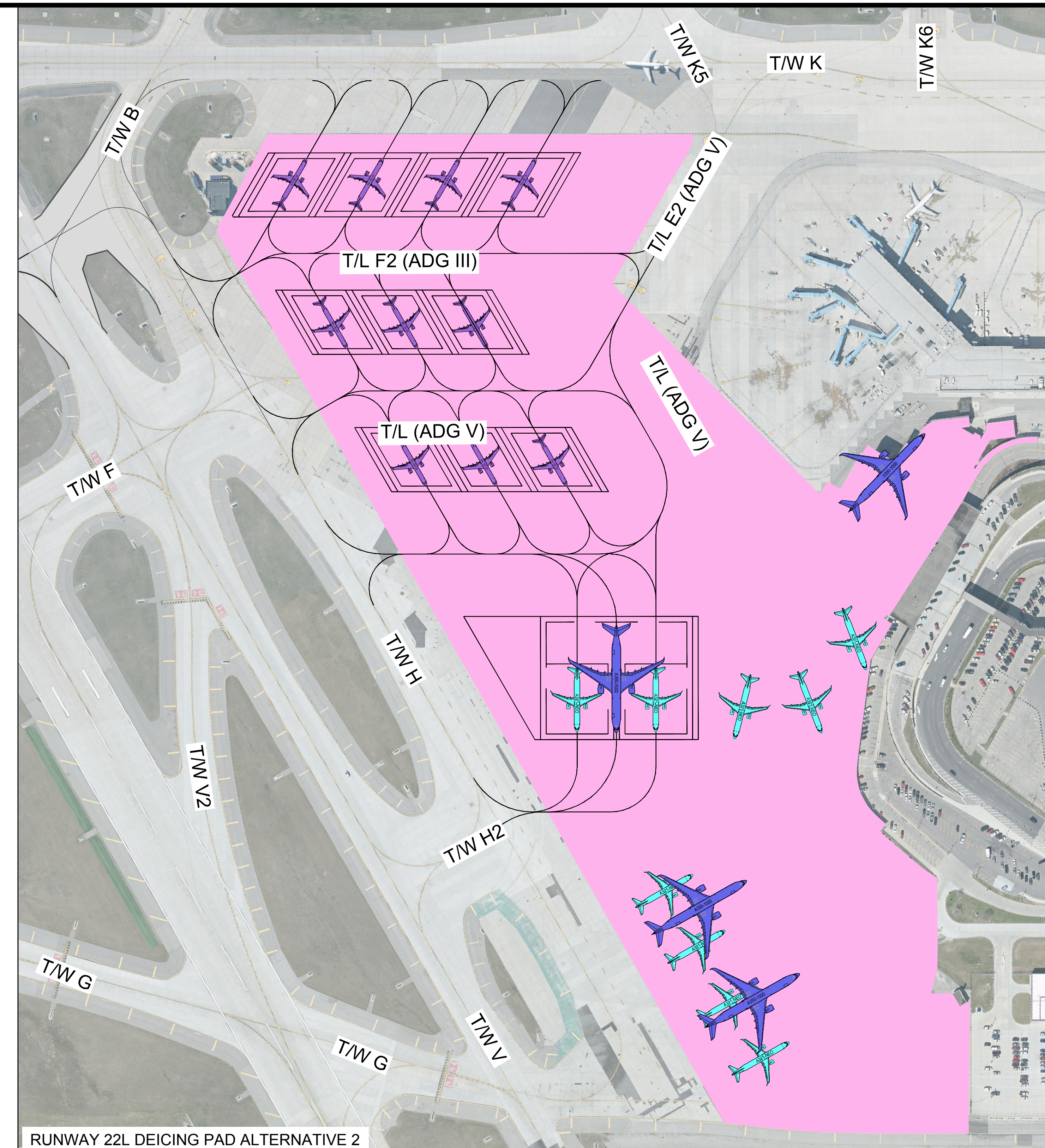
- Deicing pad with 14 narrowbody positions, 3 widebody positions, and 5 RON positions.
- Deicing pad with 10 narrowbody positions, 3 widebody positions, and 6 RON positions.
- Deicing pad with 7 narrowbody positions, 2 widebody positions, and 6 RON positions.
- Deicing pad with 6 large regional jet positions, 3 widebody positions, and 4 RON positions.
- Deicing pad with 10 large regional jet positions, 1 widebody position, and 7 RON positions.

Several considerations were added to the review of the 22L deicing pad options including preserving the ability to extend Taxiway H across John D. Dingell Drive parallel to Taxiway V, maintaining the existing W. G. Rogell Drive roadway alignment, and allowing for the implementation of one additional widebody gate at the North Terminal. Based on stakeholder input and review of the preliminary concepts, it was recommended that the 22L pad be optimized and reconfigured to meet current design standards for either narrowbody or regional jet aircraft while accommodating at least one widebody deicing position for the North Terminal carriers. Two alternatives were carried forward for detailed consideration:

- **Alternative 1** – Alternative 1, presented on Figure 6-3, proposes a site with six narrowbody deicing positions, a single widebody deicing position, and a minimum of nine RON positions. This concept provides for the reconfiguration of Taxiway K in order to meet the ADG V standard for separation between Taxiways K and Y, includes the extension of Taxiway H to the east, and provides for efficient access into and out of the deicing pad. Alternative 1 is predicated on successfully changing the utilization of the deicing pads at the Airport so that North Terminal carriers would be able to use the 22L pad and Delta Air Lines (and its regional affiliates) would make use of the other deicing pads. The estimated rough order of magnitude (ROM) cost for this alternative is $76 million.

- **Alternative 2** – Alternative 2, presented on Figure 6-3, proposes a site with 10 large regional jet deicing positions, 1 widebody aircraft deicing position and a minimum of 7 RON positions. This concept provides for the reconfiguration of Taxiway K in order to meet the ADG V standard for separation between Taxiways K and Y, includes the extension of Taxiway H to the east, and provides for efficient access into and out of the deicing pad. Alternative 2 maintains the existing deicing utilization strategy and does not shift any airlines to use of different pads, with the exception of the widebody deicing position that is available for both North Terminal carriers and for Delta Air Lines. The widebody spot, while proximate to the 10 large regional deicing spots, is physically separated from those spots. The intent is to keep the widebody spot close enough to allow deicing crews to quickly service it in a location that allows widebody aircraft to access it without significantly impacting access to the 10 large regional deicing positions. The estimated rough order of magnitude (ROM) cost for this alternative is $76 million.





LEGEND

- Future taxiway/apron pavement
- Typical widebody aircraft
- Typical narrowbody aircraft
- Typical regional aircraft
- Alternative RON widebody aircraft
- Alternative RON narrowbody aircraft

T/L	Taxilane
T/W	Taxiway

NORTH

0 150' 300' 600'

Figure 6-3
RUNWAY 22L DEICING PAD ALTERNATIVES

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The two alternatives were screened based on seven criteria. Table 6-3 compares the two alternatives under seven different metrics. The scoring is based on Negative (-), Neutral (0), and Positive (+) scores for each of the categories. The higher the positive score, the better an alternative performs against the evaluation criteria.

Table 6-3
RUNWAY 22L DEICING PAD AND RON PARKING EVALUATION MATRIX
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Evaluation Criteria	Alternative 1: Narrowbody Deicing	Alternative 2: Large Regional Jet Deicing
Minimizes cost / constructible	0	0
Maintains current utilization strategy	-	+
Right-sizes pads for future aircraft fleet mix	+	+
Provides for an additional widebody position	+	+
Considerate of proximate development	+	+
Improves operational efficiency	+	+
Addresses design standards	+	+
Total score	4 +	6 +

Source: HNTB and LeighFisher, October 2016.

Alternative 2 more closely meets the criteria established by the TAC for evaluating the 22L Deicing Pad options. All of the options require the Smith Terminal to be demolished, which has long been planned, but Alternative 2 maintains the existing utilization strategy for deicing, which was considered a significant benefit by the various stakeholders.

6.1.2.2 Runway 21R Deicing Pad

As discussed in the description of the Runway 3L-21R reconstruction alternatives, the Runway 21R deicing pad is in need of pavement reconstruction, and aircraft exiting the northernmost three deicing positions onto Taxiway M result in a penetration of the Runway 3L Departure Surface. To remedy the Departure Surface penetrations, the 21R pad can be reconfigured, as depicted on Figure 6-1 and Figure 6-2 to angle away from the departure surface. As aircraft exit the standardized deicing positions, their wings would be physically within the Departure Surface but the fuselage and aircraft tail would remain clear. To have an efficient, standards-compliant deicing pad, the existing Signature FBO taxilane connector that traverses through the deicing pad should be relocated to the south to tie into the south end of the Signature apron. This decouples traffic entering into the deicing pad from traffic entering and exiting the Signature FBO ramp. As a consequence of the relocation, approximately 290 vehicle parking spots would be eliminated from the Green Parking Lot to accommodate the taxilane. The 21R pad reconfiguration would continue to accommodate six ADG-III deicing positions for the north terminal carriers.

6.1.2.3 Runway 4R Deicing Pad

The Runway 4R pad currently services Delta mainline narrowbody and widebody aircraft. The existing pavement location and quantity of positions was determined by Delta to be sufficient throughout the planning period for the existing and forecast fleet mix. It should be noted that new, larger widebody aircraft may result in some temporary operational impacts during deicing due to length limitations of the deicing pad. The Authority does not anticipate the need for pavement reconstruction of the Runway 4R pad within the planning period, and therefore no changes are proposed for the 4R pad.

6.1.2.4 Runway 3L Deicing Pad

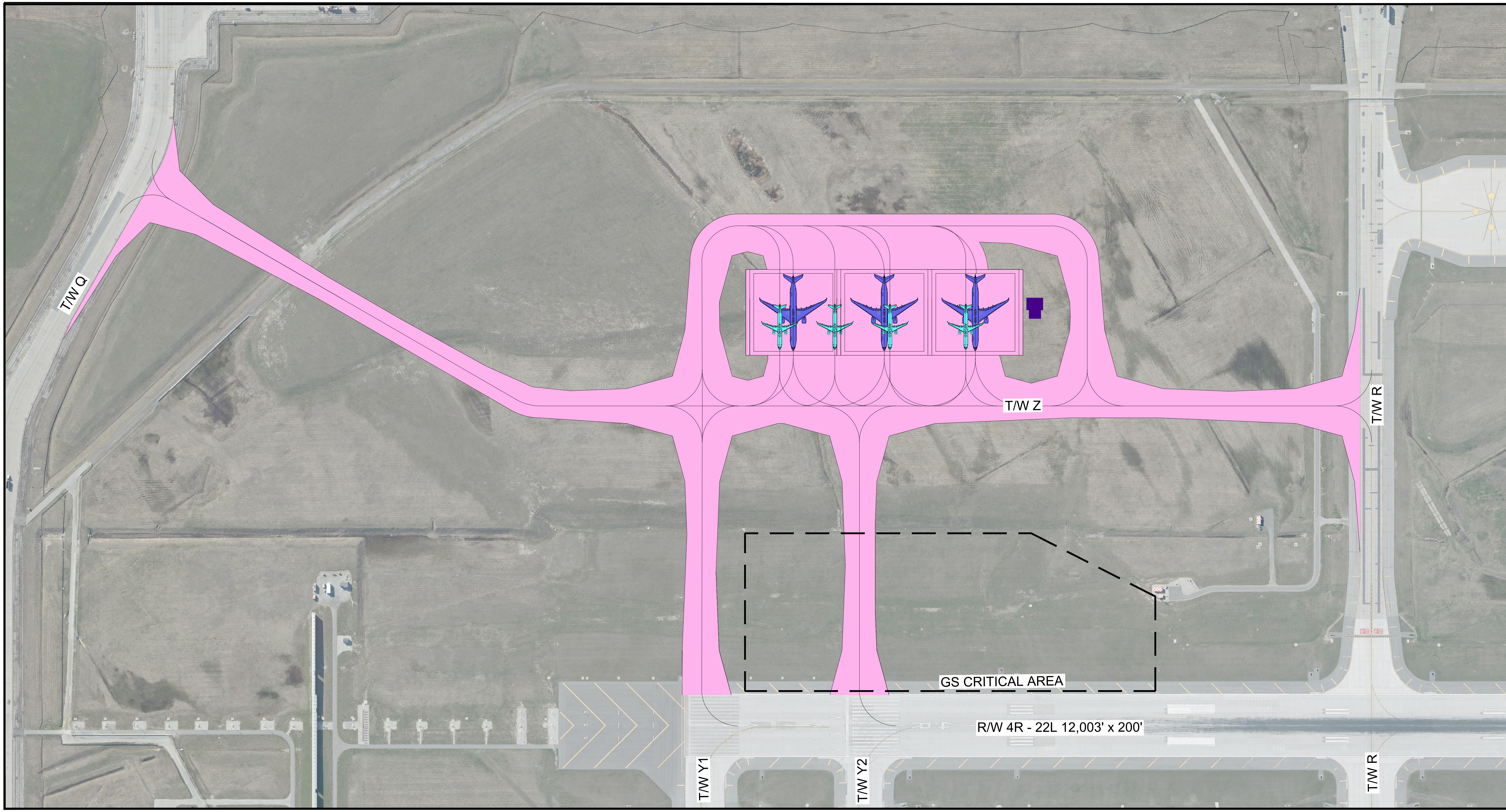
The Runway 3L pad currently services Delta mainline narrowbody aircraft. The existing pavement location and quantity of positions was determined by Delta to be sufficient throughout the planning period for the existing and forecast fleet mix. With the application of the Departure Credit, aircraft are clear of the Runway 21R Departure Surface at all points of travel. The Authority does not anticipate the need for pavement reconstruction of the Runway 3L pad within the planning period, and therefore no changes are proposed for the 3L pad.

6.1.2.5 Runway 4R West Deicing Pad

The existing four pads will adequately serve forecast demand throughout the planning period. A supplemental pad west of Runway 4R could provide future deicing capacity for the Airport for both narrowbody and widebody aircraft. As shown on Figure 6-4, the Runway 4R West pad could be constructed to flexibly accommodate multiple widebody and narrowbody aircraft, meet current FAA design standards, and provide significant capacity for the deicing operation. To provide maximum flexibility, Taxiway Z would be extended to the south to tie into the new pad to allow for aircraft to taxi to either the north end or south end of Runway 4R-22L. The pad would be configured to allow for aircraft to hold short of the Runway 4R glideslope critical area while keeping clear of the Taxiway Z TOFA to enable free-flowing traffic along Taxiway Z. Optimally, the pad would also connect to Taxiway Q to allow aircraft to use the end-around-taxiway to reach the pad. Other aircraft would cross Runway 4R-22L at Taxiway Y1 and enter the pad. Departing aircraft in north flow would enter Runway 4R at Taxiway Z2. The need for this expansion project should be re-evaluated in the next Master Plan Update. The estimated rough order of magnitude (ROM) cost for this alternative is $60 million.

6.1.2.6 Additional RON Parking Positions

In addition to the RON reconfiguration at the Runway 22L pad, another area of RON expansion is provided by the demolition of Building 715 and addition of aircraft-rated pavement. As illustrated on Figure 6-5, this allows for one additional widebody aircraft parking position or up to two narrowbody aircraft parking positions. The Berry Terminal is also scheduled for near-term removal. The number of RON parking positions adjacent to the Berry Terminal will not be impacted or increased as a result of the removal of the Berry Terminal.



LEGEND

Future taxiway/apron pavement

R/W Runway

T/W Taxiway

NORTH

0 150' 300' 600'

Figure 6-4
RUNWAY 4R WEST DEICING PAD & TAXIWAY Z EXTENSION
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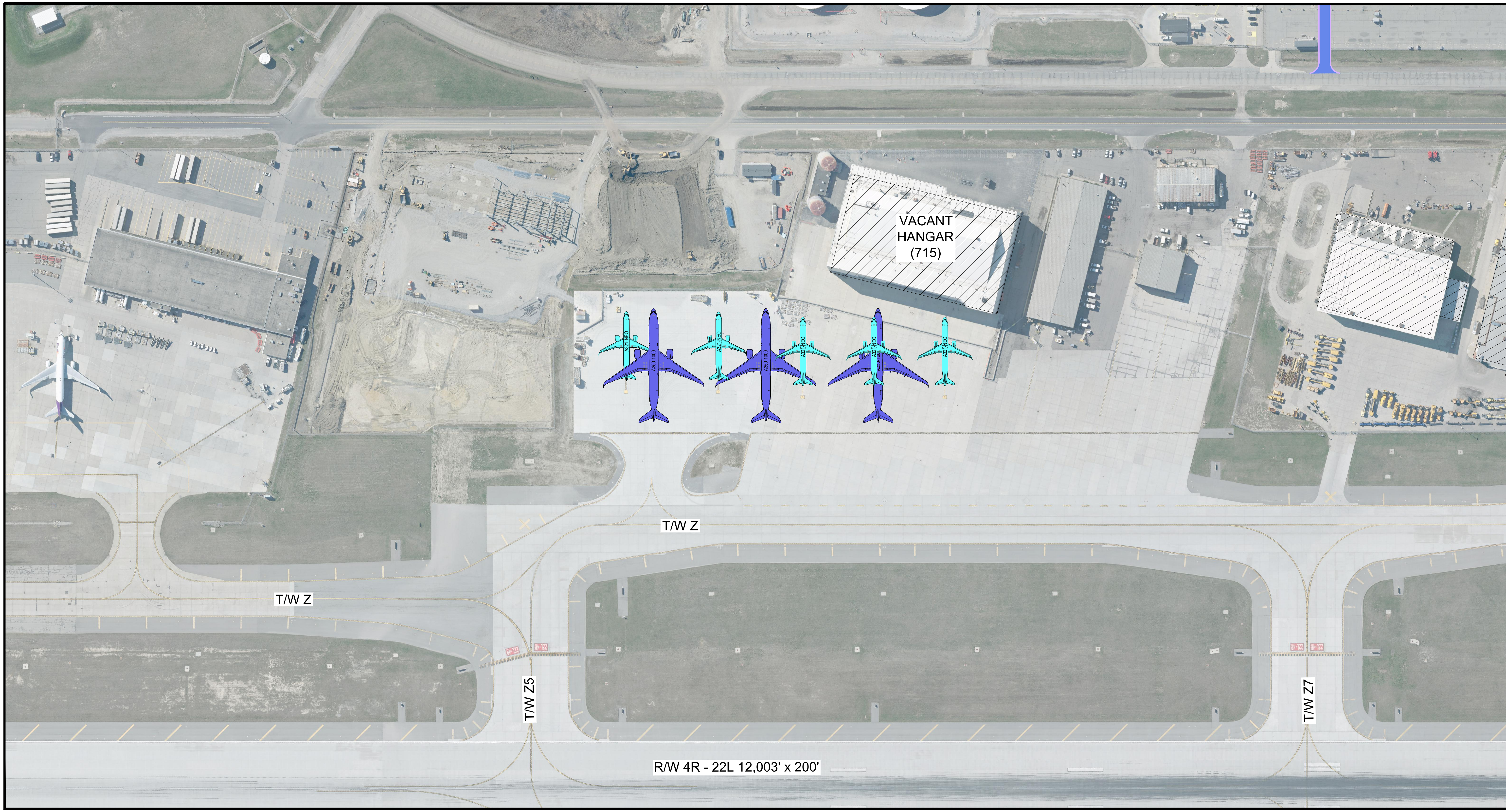

LEGEND

Future building/pavement removal

R/W Runway

T/W Taxiway

NORTH

0 100' 200' 400'

Figure 6-5
RON PARKING POSITIONS WITH DEMOLITION OF BUILDING 715

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6.1.3 Other Airfield Improvements

The following summarizes additional airfield improvements that were considered in the Master Plan.

6.1.3.1 Geometry Standards

A number of alternatives were proposed to address the following non-standard geometries:

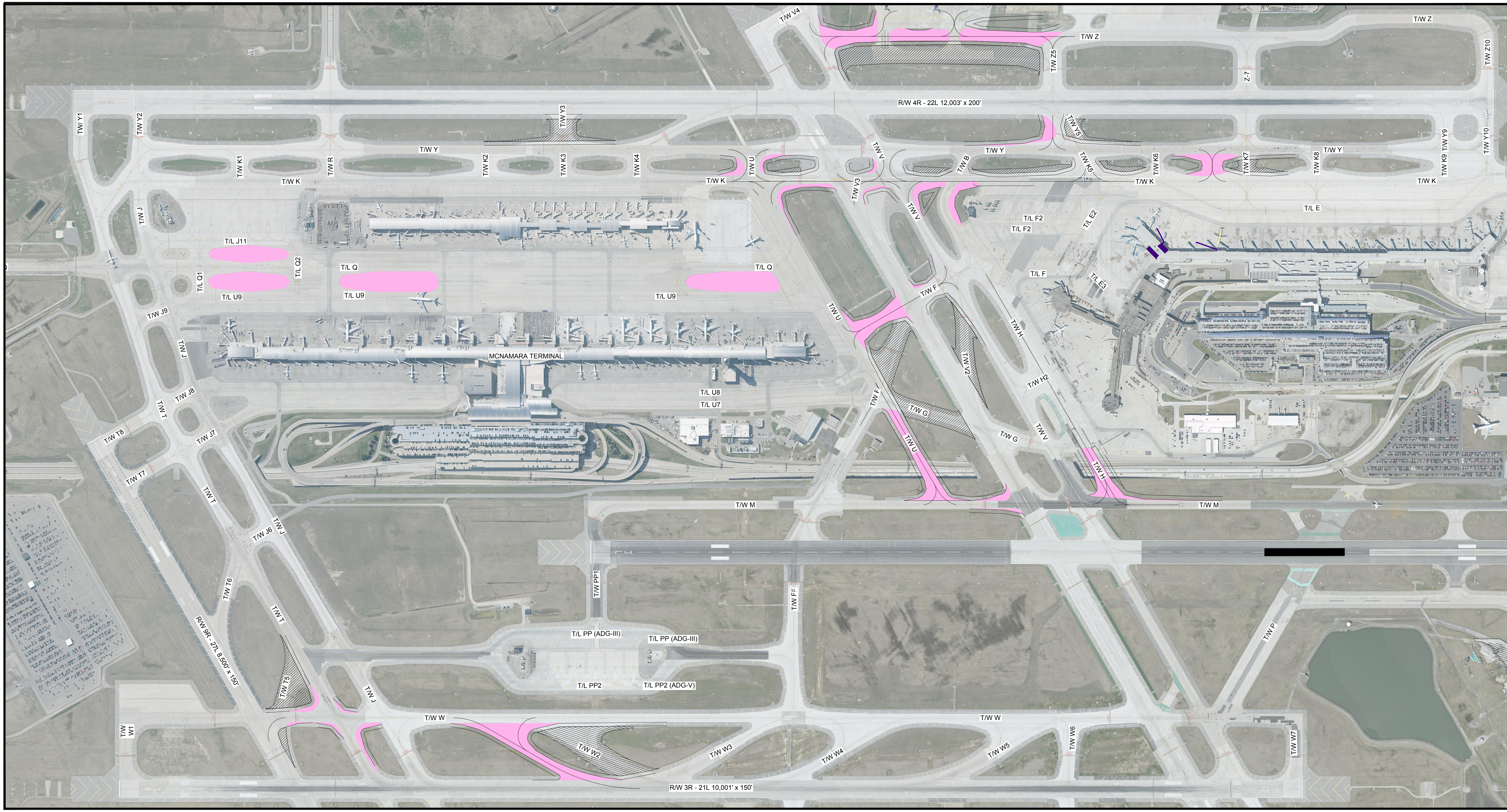
- **Taxiway Z Realignment** – Taxiway Z between Taxiways Z5 and V is separated from Runway 4R-22L by 400 feet, and north of Taxiway Z5, the separation is 557 feet. For CAT II/III approaches, this separation is required to be a minimum of 500 feet. As depicted on Figure 6-6, the Authority has advanced a design to relocate the sub-standard portion of Taxiway Z to match the alignment of Taxiway Z north of Taxiway Z5. The estimated rough order of magnitude (ROM) cost for this alternative is $14 million.

- **Runway 27L ROFA Beyond Stop End of Runway** – The Runway 27L ROFA beyond the stop end of the runway (Runway 9R end) is penetrated by the vehicle service road and requires a relocation of the roadway to meet design standards as presented on Figure 6-7. The estimated ROM cost for this alternative is $611,000.

- **Runway 9L ROFA Beyond Stop End of Runway** – The Runway 9L ROFA beyond the stop end of the runway (Runway 27R end) is penetrated by the vehicle service road and requires a relocation of the roadway to meet design standards as presented on Figure 6-7. The relocation of the roadway requires the infill or bridging of the retention ponds on each side of the roadway. The estimated ROM cost for this alternative is $400,000.

- **Runway 3R ROFA Beyond Stop End of Runway** – The Runway 3R ROFA beyond the stop end of the runway (Runway 21L end) is penetrated by the vehicle service road and requires a relocation of the roadway to meet design standards as presented on Figure 6-7. The relocation of the roadway requires the infill or bridging of the retention ponds on each side of the roadway. The estimated ROM cost for this alternative is $400,000.

- **Taxiway K Geometry** – As discussed in the Runway 22L Deicing Pad alternatives, the separation between Taxiways K and Y between K6 and U is nonstandard. To remedy this non-standard condition as presented on Figure 6-6, Taxiway K will be realigned to meet standards. This includes the relocation of the centerline and the widening of fillets to meet design standards. The estimated ROM cost for this alternative is $7.4 million.



LEGEND

Future taxiway/apron pavement

Future building/pavement removal

R/W Runway

T/L Taxilane

T/W Taxiway

NORTH

0 400' 800' 1600'

Figure 6-6
PROPOSED AIRFIELD GEOMETRY MODIFICATIONS

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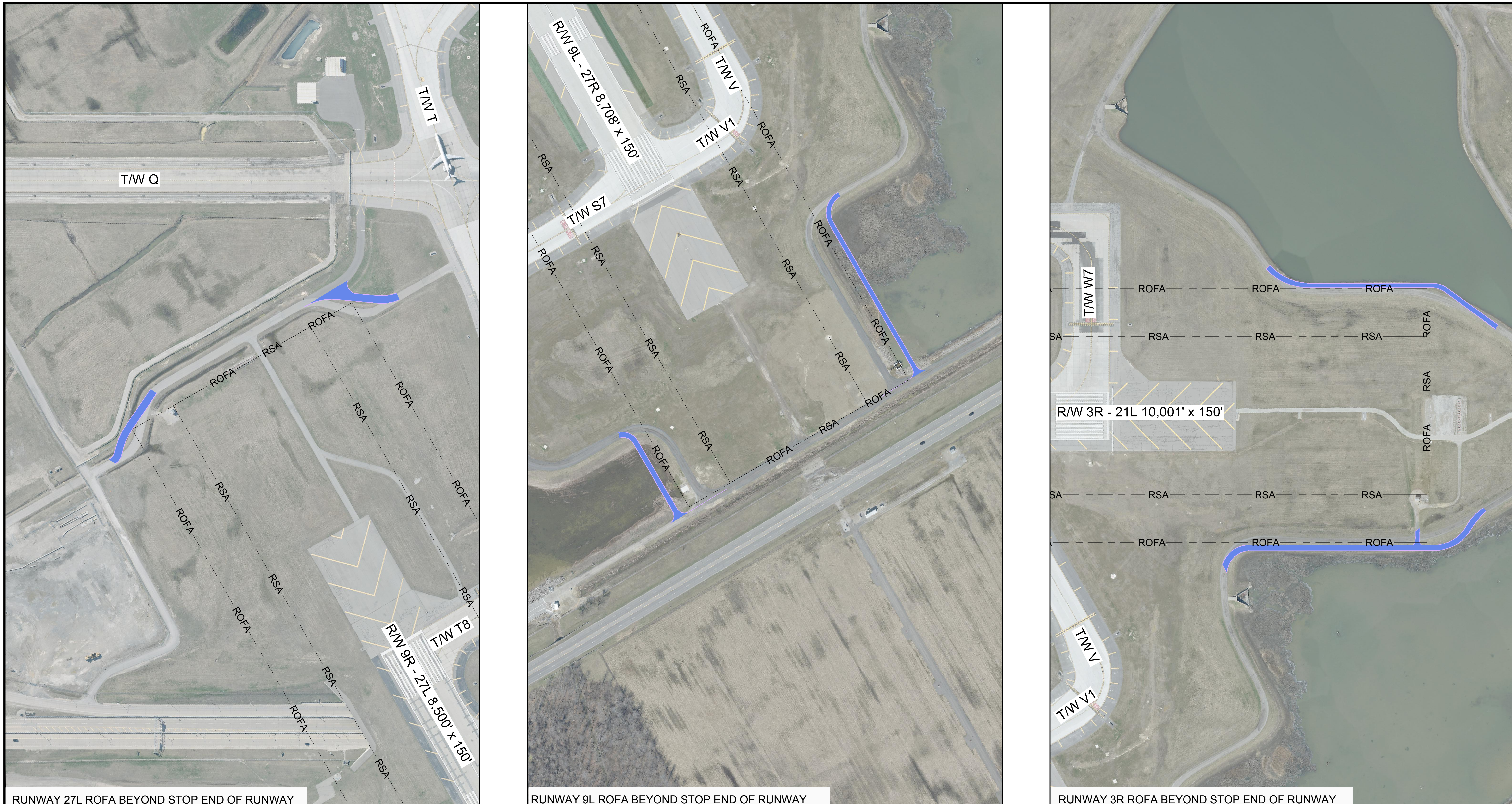

LEGEND

Future airport service road
RSA — Runway safety area
ROFA — Runway object free area
R/W — Runway
T/W — Taxiway

NORTH

0 150' 300' 600'

Figure 6-7
RUNWAY ROFA BEYOND STOP END OF RUNWAY

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6.1.3.2 Runway Incursion Mitigation Improvements

A number of alternative improvements were proposed to reduce the risk of a runway incursion and/or surface incident. The improvements were identified based on an historical analysis of past incursions and incidents at the Airport and prioritize these areas based on the potential severity of an incursion. The following improvements were considered:

- **Taxiway F Reconfiguration** – As part of the Runway 3L-21R reconstruction project, Taxiway F could be reconfigured to reduce the potential for pilots to lose situational awareness on a long, straight taxi along Taxiway F which intersects and crosses Runway 3L-21R at an angle. By reconfiguring the crossing to a 90-degree intersection with the runway aligned with the portion of Taxiway F, east of Runway 3L-21R, aircraft taxiing along Taxiway F will be required to make a situational awareness turn onto Taxiway M prior to crossing Runway 3L-21R. As depicted on Figure 6-6, the 90-degree perpendicular crossing also improves visual acuity of aircraft potentially rolling out on Runway 3L-21R and reduces the crossing distance. The estimated rough order of magnitude (ROM) cost for this alternative is $9.2 million.

- **Taxiway W2 Relocation** – The de-coupling of Taxiways W2 and W3 by relocating W2 to the south eliminates a wide-expanse of pavement where the two taxiways join. During low visibility and snow-accumulation conditions, it can be challenging to decipher which taxiway to turn onto. A modest relocation of Taxiway W2, as depicted on Figure 6-6 could eliminate the wide expanse of pavement without significantly increasing runway occupancy times on Runway 3R-21L. The estimated rough order of magnitude (ROM) cost for this alternative is $8.8 million.

- **Taxiway W Geometry** – To eliminate a potentially confusing geometry that results in a wide-expanse of pavement at the intersection of Runway 9R-27L with Taxiways W and T5, it is proposed that Taxiway T5 be demolished. By demolishing Taxiway T5, the number of decision points and directions for pilots exiting or crossing Runway 9R-27L is reduced to improve situational awareness. To meet design standards, the fillets for Taxiway W onto Taxiways J and T would be enhanced to meet FAA design standards. This configuration is illustrated on Figure 6-6. The estimated rough order of magnitude (ROM) cost for this alternative is $3.6 million.

- **Taxiways U, G, U2, and V2 Improvements** – The intersection of Taxiways U2, V2, G, F, U and Taxilanes U7 and U8 in close proximity to Runway 9L-27R and the McNamara Terminal results in a complex intersection with multiple acute angle runway crossings. As illustrated on Figure 6-6, to simplify geometry, reduce the potential for a runway incursion, and maintain efficiency, a concept was developed to demolish existing Taxiways G and V2 south of Runway 9L-27R, and construct a 90 degree crossing of Runway 9L-27R aligned with Taxiway V2 north of Runway 9L-27R, as well as extend Taxiway U across John D. Dingell Drive and connecting into Taxiway M. The perpendicular reconstruction of Taxiway V2 will improve the situational awareness of the runway crossing and will reduce the physical length of the crossing. The extension of Taxiway U allows for the southern portion of Taxiway G to be demolished, in effect eliminating a runway crossing in the high-energy portion of the runway. The extension of Taxiway U also provides enhanced access for aircraft coming into or out of the McNamara Terminal to/from Runways 3L-21R and 3R-21L. The extension may also reduce the frequency for which ATC assigns aircraft to taxi along Runway 9L-27R. The estimated rough order of magnitude (ROM) cost for this alternative is $19.7 million.

- **Taxiway Y3 Demo** – To eliminate the potential of an aircraft errantly entering Runway 4R-22L coming out of the McNamara Terminal, as presented on Figure 6-6, it is proposed that Taxiway Y3 be demolished or closed. A potential relocation of Taxiway Y3 was determined to be unnecessary by key Airport stakeholders from a runway occupancy and efficiency standpoint. The estimated rough order of magnitude (ROM) cost for this alternative is $1 million.

- **Taxiway Y5 Geometry** – Taxiway Y5 is currently designated as an ADG VI runway crossing for Runway 4R-22L. The taxiway crosses Runway 4R-22L at an acute angle, which ties directly into Taxiway K5 and the North Terminal apron. To enhance situational awareness, reduce the length of the crossing, and continue to meet FAA standards, Taxiway Y5 is proposed to be reconfigured to a 90-degree perpendicular crossing as shown on Figure 6-6. The estimated rough order of magnitude (ROM) cost for this alternative is $2.7 million.

- **Taxiway K7 Geometry** – Taxiway K7 is proposed to be relocated to eliminate the direct runway entrance and crossing from the North Terminal. As illustrated on Figure 6-6, a modest shift of Taxiway K7 will enhance pilot situational awareness and reduce the possibility of an errant entrance into the protected surfaces of Runway 4R-22L. The estimated rough order of magnitude (ROM) cost for this alternative is $3.8 million.

6.1.3.3 Efficiency Improvements

In addition to the standards-compliance improvements and RIM geometry improvements, two additional improvements were identified to improve overall airfield efficiency. These include the following:

- **McNamara Island Infill** – As depicted on Figure 6-6, four islands within the non-movement area between the McNamara Terminal Concourses A and B/C are proposed to be infilled with aircraft-rated pavement in order to enhance the efficiency of aircraft movements. The island infill allows for aircraft to more easily move between Taxilanes Q and U9 and will provide for enhanced ingress into the Runway 4R deicing pad. The estimated rough order of magnitude (ROM) cost for this alternative is $15.3 million.

- **Taxiway H Bridge** – A potential extension of Taxiway H across John D. Dingell Drive could enhance the efficiency of aircraft accessing Runway 21R from the North terminal as well as enhance the access into and out of the Runway 22L deicing pad. The extension requires a bridge structure over the roadway, as depicted on Figure 6-6. The extension could also result in fewer ATC assignments of using Runway 9L-27R as a taxiway. The estimated rough order of magnitude (ROM) cost for this alternative is $16.2 million.

6.2 GROUND TRANSPORTATION AND PARKING ALTERNATIVES

The following summarizes alternatives considered to improve roadways, curbsides, parking, and rental car facilities at the Airport. Alternatives were developed based on the facility requirements discussed in Chapter 5, supplemental data collection, and input from Authority staff and the CAC and TAC stakeholder groups. Alternatives focused on addressing not only deficiencies in requirements but also operational enhancements.

6.2.1 Airport Roadways

Airport roadways include both the terminal access roadways and non-terminal roadways and intersections that provide access to terminal, parking, rental car, and other support facilities. Facility requirements determined, with the exception of the intersection of W. G. Rogell Drive and Burton Drive, the Airport roadways have sufficient capacity to accommodate forecast demand throughout the 20-year planning horizon. As a result, the focus of the roadway alternatives was to improve operations at four key areas:

- **Return-to-North Terminal Movement** – Currently, vehicles at the North Terminal that need to return to the curbsides or parking along with those accessing the North Terminal from the south must make a U-turn at the intersection of W. G. Rogell Drive and Burton Drive. This movement slows down the traffic flow due to the tight turn and flow of on-coming southbound traffic on W. G. Rogell Drive. Queues also build along northbound W. G. Rogell Drive as vehicles wait to make the turn.

- **Intersection of W. G. Rogell Drive and Burton Drive** – This signal, providing access to the east and west service drives, experiences congestion in the southbound turn lane on W. G. Rogell Drive along with the eastbound and westbound movements along Burton Drive. This congestion is projected to increase through the planning horizon.

- **North Terminal to McNamara Terminal Connection** – Current operations require vehicles exiting the North Terminal heading south to the McNamara Terminal or Eureka Road to exit the North Terminal northbound on W. G. Rogell Drive and make a U-Turn at the Burton Drive intersection to head back to the south.

- **Big Blue Parking Deck Parking Exit** – The existing exit roadway from the Big Blue Parking Deck exit plaza abruptly merges with the outbound North Terminal roadway and provides limited sight distance or space to merge safely with outbound traffic.

6.2.1.1 W. G. Rogell Drive Reconfiguration

Three roadway options were developed to improve the return-to-North Terminal movement and operations at the intersection of W. G. Rogell Drive and Burton Drive.

Option 1, shown on Figure 6-8, addresses the return-to-terminal movement for vehicles accessing the North Terminal by providing a dedicated flyover over the intersection of W. G. Rogell and Burton drives, connecting the northbound and southbound W. G. Rogell Drive movements. The flyover would replace the northbound U-turn movement at the intersection reducing queueing at the intersection in the northbound direction. No other intersection operations are addressed in this option and access to facilities along the east and west service drives remain the same as current conditions. The rough order of magnitude cost to construct this flyover is estimated at $13.4 million.

Figure 6-8
OPTION 1: W. G. ROGELL DRIVE FLYOVER
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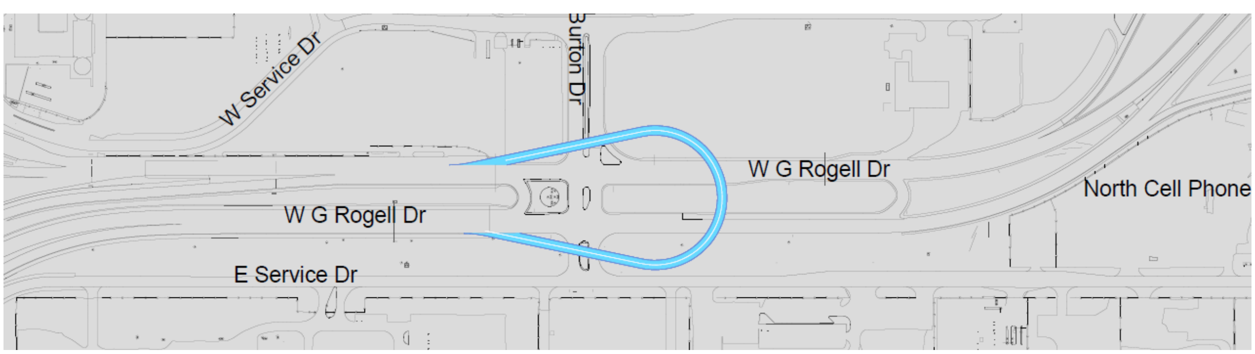

Source: LeighFisher and HNTB, January 2017.

Option 2, shown on Figure 6-9, realigns W. G. Rogell Drive to provide a larger median between the northbound and southbound lanes, providing space for a cell phone lot and commercial development. Burton Drive is split with access to the west service road moving north along W. G. Rogell Drive and access to the East Service Drive moving south. At-grade, non-signalized movements provide continuous flow merge and diverge movements connecting the northbound and southbound movements on either side of the enlarged median. As shown on Figure 6-9, rental car shuttles could use a dedicated slip-ramp off of northbound W. G. Rogell Drive tying into Lucas Drive to access the existing rental car sites from the terminals.

Figure 6-9
OPTION 2: ROGELL-BURTON REALIGNMENT – NON-SIGNALIZED
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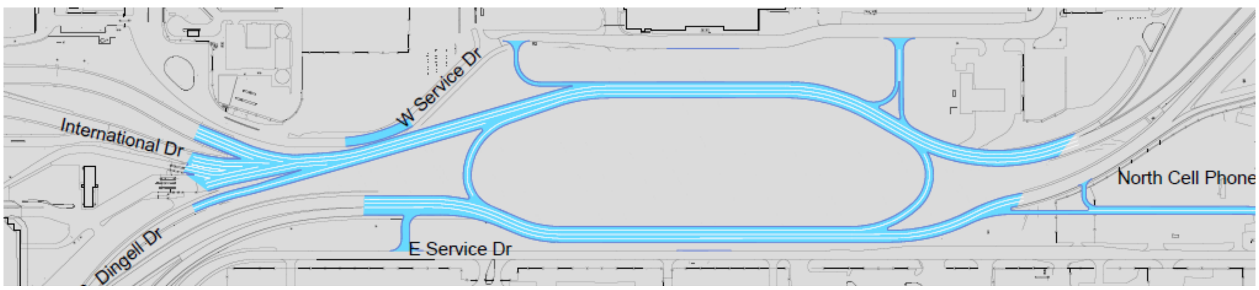
Detroit Metropolitan Wayne County Airport



Source: LeighFisher and HNTB, January 2017.

Option 2 allows the free flow of vehicles entering and exiting the Airport property, provides a clearly-defined recirculation movement, and includes median space for a cell phone lot and commercial development. The access to the east and west service drives would be offset, allowing distance to weave to the opposite side of W. G. Rogell Drive after vehicles make a turn from northbound to southbound or vice versa to exit onto the service roads. Under this option, two new weaving sections would be created: (1) along southbound W. G. Rogell Drive with Return-to-North Terminal traffic crossing traffic entering the Airport and (2) along northbound W. G. Rogell Drive with Return-to-Terminal and traffic bound for the west service road crossing traffic exiting the Airport. Based on preliminary weaving analysis as prescribed in ACRP Report 40, *Airport Curbside and Terminal Area Roadway Operations*, which adapts Highway Capacity Manual criteria for use in slow speed airport conditions, both of these weaving sections are expected to operate with a Level of Service B, which exceeds the minimum requirement of Level of Service D. A rough order of magnitude cost to construct this roadway configuration is estimated at $17.6 million.

The roadway configuration in Option 3, shown on Figure 6-10, is similar to Option 2, but includes signals at the Burton Drive intersections. The return-to-terminal movement could be free-flow with an add lane to reduce the conflict with through traffic along W. G. Rogell Drive at the signals. Sufficient queuing capacity must be provided at the intersections. Similar to Option 2, rental car shuttles could use a dedicated slip-ramp off of northbound W. G. Rogell Drive tying into Lucas Drive to access the existing rental car sites from the terminals. A rough order of magnitude cost to construct this roadway configuration has been estimated at $17.6 million.

Figure 6-10
OPTION 3: ROGELL-BURTON REALIGNMENT – SIGNALIZED
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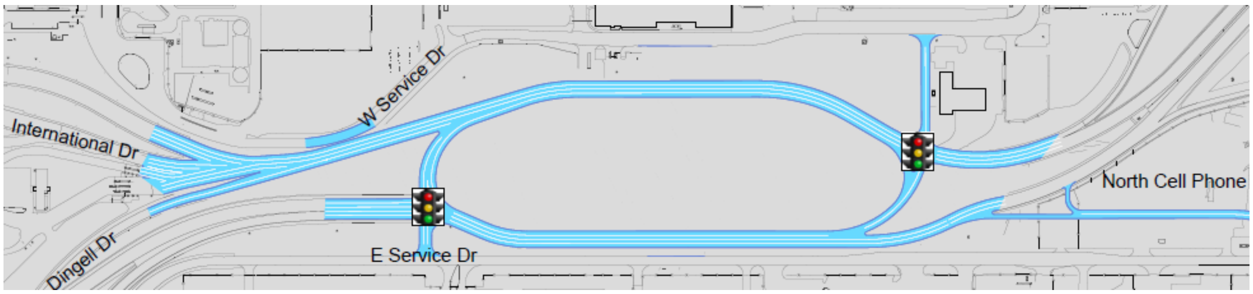
Detroit Metropolitan Wayne County Airport



Source: LeighFisher and HNTB, January 2017.

As with Option 2, two new weaving sections would be created: (1) along southbound W. G. Rogell Drive with Return-to-North Terminal traffic crossing traffic entering the Airport; and (2) along northbound W. G. Rogell Drive with Return-to-Terminal traffic crossing traffic exiting the Airport one in the northbound direction of W. G. Rogell Drive. However, the traffic signals significantly reduce the impact of the weave as traffic is metered at the signal allowing space for vehicles to weave across the lanes on W. G. Rogell Drive. Based on preliminary weaving analysis as prescribed in ACRP Report 40, *Airport Curbside and Terminal Area Roadway Operations*, which adapts Highway Capacity Manual criteria for use in slow speed airport conditions, both of these weaving sections are expected to operate with a Level of Service B, which exceeds the minimum requirement of Level of Service D.

The three options were screened based on six criteria, which are compared in Table 6-4. The scoring is based on Negative (-), Neutral (0), and Positive (+) scores for each of the categories. The higher the positive score, the greater an alternative performs against the evaluation criteria.

All three options provided the needed Return-to-Terminal movement along W. G. Rogell Drive but only Options 2 and 3 improved the W. G. Rogell-Burton intersection and materially improved operations along W. G. Rogell Drive. Option 3 has the additional benefit of providing direct access to the service roads through signalization, which effectively eliminated the weaving sections along W. G. Rogell Drive further improving traffic flow and access to the East and West Service Drives.

Table 6-4
W.G. ROGELL DRIVE RECONFIGURATION EVALUATION MATRIX
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	Option 1: W. G. Rogell Drive Flyover	Option 2: W. G. Rogell-Burton Realignment - Non-Signalized	Option 3: W. G. Rogell-Burton Realignment - Signalized
Minimizes cost / constructability	+	0	0
Provides return-to-terminal movement	+	+	+
Improves operations at the W. G. Rogell-Burton intersection	-	+	+
Improves vehicle movement along W. G. Rogell Drive	-	0	+
Improves access to the east and west service drives	-	0	+
Provides opportunity for commercial development accessible by inbound and outbound vehicles	-	+	+
Total score	2-	3+	5+

Source: HNTB, August 2016.

6.2.1.2 Rogell-Dingell Drive Connector and Big Blue Parking Deck Exit

Currently, all traffic leaving North Terminal is directed to northbound W. G. Rogell Drive. Vehicles traveling south to the McNamara Terminal or Eureka Drive must make a U-turn at the signalized intersection of W. G. Rogell Drive at Burton Drive. In addition, the exit lanes from the Big Blue Parking Deck exit plaza abruptly merge with the outbound North Terminal roadway, providing limited sight distance or space to safely enter the North Terminal exit roadway.

Two options were developed to connect W. G. Rogell Drive to Dingell Drive in the southbound direction and improve the Big Blue Parking Deck exit.

Option 1, shown on Figure 6-11, constructs a new flyover ramp from W. G. Rogell Drive as it exits the North Terminal adjacent to the Big Blue Parking Deck to southbound John D. Dingell Drive. The flyover would diverge from the outer lanes of W. G. Rogell Drive, opposite the Big Blue Parking Deck, and cross over the East Service Drive with a bridge structure, connecting to southbound John D. Dingell Drive. To achieve sufficient length for the flyover ramp to ascend above the East Service Drive, this alternative requires a northward relocation of the existing East Service Drive access point. In addition to the flyover ramp, this option would reconfigure the Big Blue Parking Deck exit lanes to increase the length of acceleration lane, and provide a shallower merging angle between the parking exit lane and W. G. Rogell Drive. The reconfiguration would move the merge point further north along W. G. Rogell Drive, so drivers leaving the Big Blue Parking Deck would be prohibited from weaving to the right across traffic to access the Rogell-Dingell Connector. Drivers exiting the Big Blue Parking Deck and heading south may still be required to exit northbound along W. G. Rogell Drive and make a U-turn to return south, as they do today. Under this option, a two-sided weaving section is created, but the distance between roadways ramps is sufficient to provide a Level of Service A, which exceeds the minimum requirement of Level of Service D. A rough order of magnitude cost to construct this flyover is estimated at $2.0 million.

Figure 6-11
ROGELL-DINGELL CONNECTOR OPTIONS
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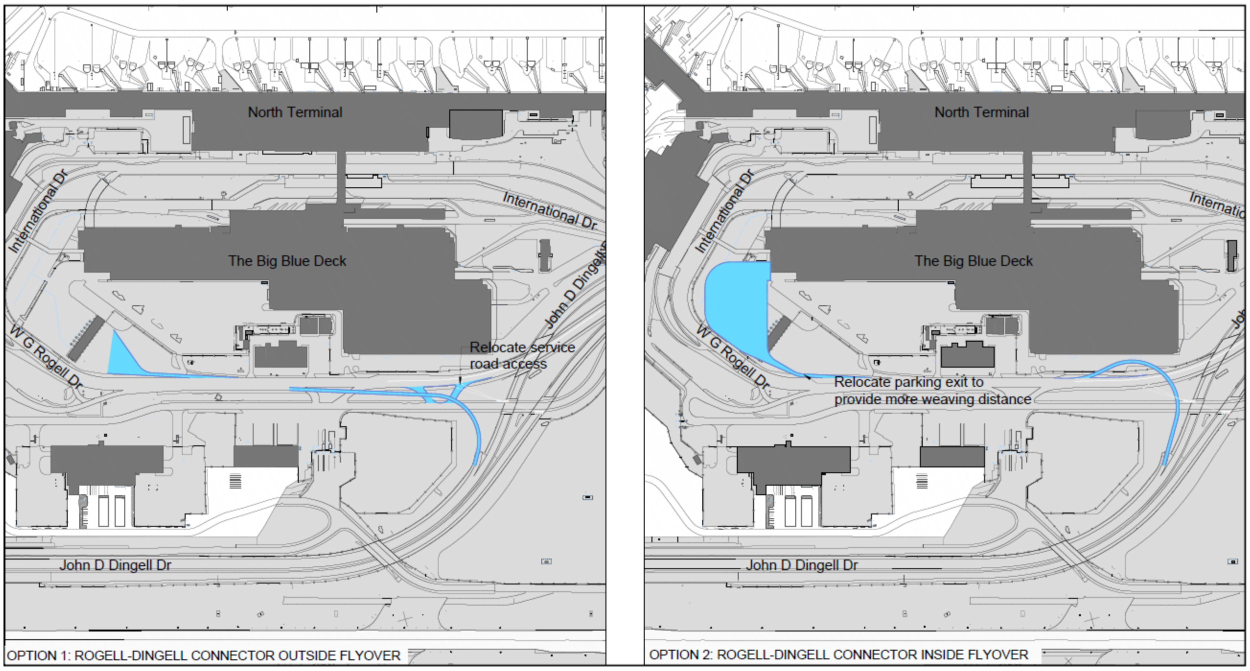
Detroit Metropolitan Wayne County Airport



Source: LeighFisher and HNTB, January 2017.

Option 2 constructs a new flyover ramp from W. G. Rogell Drive at the North Terminal Exit to southbound John D. Dingell Drive from the inside W. G. Rogell Drive lanes closest to the Big Blue Parking Deck. As shown on Figure 6-11, the flyover ramp would ascend in the space between northbound W. G. Rogell Drive and the Big Blue Parking Deck, and cross over both W. G. Rogell Drive and the East Service Drive with a bridge structure before merging with the elevated overpass portion of southbound John D. Dingell Drive. This option would allow traffic leaving the Big Blue Parking Deck to use the connector to access southbound John D. Dingell Drive. However, a new weaving movement would be created requiring all traffic leaving the Big Blue Parking Deck and heading north to cross the traffic accessing the connector. To provide sufficient weaving distance between existing Big Blue Parking Deck exit and the potential diverge point of the connector, the Big Blue Parking Deck exit plaza would require relocation to the south providing additional weaving distance but increasing the cost. A rough order of magnitude cost to construct this flyover is estimated at $2.5 million.

The alternatives were screened based on a variety of criteria as shown in Table 6-5, which compares the options under six different metrics. The scoring is based on Negative (-), Neutral (0), and Positive (+) scores for each category. The higher the positive score, the greater an alternative performs against the evaluation criteria.

Table 6-5
ROGELL-DINGELL CONNECTOR EVALUATION MATRIX
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	Option 1: Outside Flyover	Option 2: Inside Flyover
Minimizes cost / constructible	+	-
Provides connection to southbound Dingell Drive for all vehicle movements	0	+
Provides sufficient weaving space	+	0
Improves parking exit	+	+
Total score	**3+**	**1+**

Source: HNTB and LeighFisher, October 2016.

Both options provide a direct connection from W. G. Rogell Drive to John D. Dingell Drive, while improving safety and traffic flow from the Big Blue Parking Deck exit plaza. While Option 1 does not provide easy access to the flyover for vehicles exiting the Big Blue Parking Deck, it does provide better weaving conditions for all exiting vehicles as they do not need to cross the vehicles exiting the Big Blue Parking Deck to access the flyover. In addition the estimated construction cost of the outside flyover would be less because it has a shorter elevated section and does not require reconfiguration of the entire parking exit plaza.

6.2.2 Curbside Facilities

Airport curbside facilities are comprised of separate arrivals and departures curbsides along with Ground Transportation Centers (GTCs) at both terminals and the international arrivals curbside at the McNamara Terminal. The following deficiencies and future capacity considerations were considered:

- **McNamara Terminal Departures Curbside** – Currently, the private vehicle drop-off portion of the departures curbside is deficient by 15 feet increasing to 115 feet by PAL 3. Dwell times on this curbside are in the expected range and a reallocation of the hotel valet curb and dedicated inter-terminal shuttle zone to expand the private vehicle drop-off area is recommended to provide sufficient capacity for curbside activity in the future.

- **McNamara Terminal Domestic Arrivals Curbside** – With observed long vehicle dwell times, this curbside is currently deficient by approximately 625 feet; however, with operations limited to active loading only it is estimated that the arrivals level has sufficient length and number of lanes to meet demand through PAL 3. It is recommended that curbside enforcement is used to limit vehicle dwell times to active loading only during peak periods, eliminating the need for expanded arrivals curbsides.

- **McNamara Terminal International Arrivals Curbside** – The international curbside is currently deficient by 630 feet increasing to 760 by PAL 3. Dwell times recorded on this curbside are in the expected range reflecting active loading activity only with no extended dwelling of vehicles.

- **McNamara Terminal Ground Transportation Center** – Currently, the McNamara Terminal GTC has a 240-foot deficit in curbside length with hotel, parking and rental car shuttles requiring additional length. With a reduction of rental car dwell times to reflect active loading and unloading, with no staging of vehicles, this deficit is reduced to 100 feet but increases to 210 feet by PAL 3.

- **North Terminal Arrivals Curbside** – With observed long vehicle dwell times, this curbside is currently deficient by approximately 600 feet; however, with operations limited to active loading only it is estimated that the arrivals level has sufficient length and number of lanes to meet demand through PAL 1 and will require an additional 100 feet by PAL 3.

- **North Terminal Ground Transportation Center** – Sufficient space is available to accommodate ground transportation operations through the 20-year planning horizon; however, a reallocation of space among hotel, parking and rental car shuttles may be required to accommodate additional modes such as increased express bus and planned Regional Bus Rapid Transit (BRT) service. Currently, shuttle drivers take breaks at the North Terminal GTC. The resulting extended dwell times do not currently affect capacity but this will need to be monitored through the planning horizon to limit dwell times as capacity issues arise.

6.2.2.1 Cell Phone Lot Relocation and Expansion

To address the deficiencies at the McNamara and North Terminal Domestic Arrivals Curbs observed currently and projected through the 20-year planning horizon, increased curbside enforcement is recommended along with a relocation and expansion of the existing cell phone lots to accommodate vehicles moved from the curbside. There are currently two cell phone lots, one north and one south of the terminals. The North Cell Phone Lot is located along the East Service Drive adjacent to the commercial vehicle hold lot. Although signs direct drivers to its location, the lot is not visible from the main Airport entrance and it is off the main path to the Airport; as a result, usage is limited. A temporary cell phone lot is also located off Southbound W. G. Rogell Drive north of the North Terminal, however, pavement in the lot is in poor condition and the lot is not consistently utilized. The South Cell Phone Lot is located along Eureka Road between I-275 and John D. Dingell Drive on the primary path to the McNamara Terminal from the freeway. Through discussions with the CAC and TAC stakeholder groups it was determined that the South Cell Phone Lot, which sees a lot of activity, is currently in a convenient location although expansion of the lot should be considered in the future, possibly with development of a South Remote Public Parking Lot. In the same discussions, it was determined that the North Cell Phone Lot should be relocated to provide better visibility and accessibility. It is recommended that the North Cell Phone Lot be relocated along W. G. Rogell Drive, north of the southbound lanes prior to the North Terminal. The temporary lot could be upgraded with new pavement and striped off parking spaces until the W. G. Rogell Drive Realignment occurs, when the North Cell Phone Lot could be placed in the enlarged median between the southbound and northbound lanes. It is recommended that amenities such as Flight Information Displays (FIDS), restrooms, and concessions vendors be considered. These could be tied to future commercial development in the same area. Not providing a larger, more convenient North Cell Phone Lot while increasing curbside enforcement will result in more recirculating vehicles along the Airport roadways and increased congestion. Rough order of magnitude cost estimates for this option vary depending on final location and sizing.

6.2.2.2 McNamara Terminal International Arrivals Curbside

The McNamara International Arrivals Curbside is located on the bottom of the three terminal levels. The curbside is 420 feet long, however, only 240 feet are dedicated to private vehicle pick-up. The remainder of the curb is dedicated to employee shuttle, TSA, and CBP vehicle parking. In addition, a Delta Dash drop-off facility and the primary McNamara Terminal landside loading dock are located on the south end of the curb further restricting space. During the early morning hours, coinciding with the international arrivals peak hour, trucks backing into loading bays stop curbside traffic while they maneuver into spaces.

Two Options were reviewed to address the deficiencies in the international arrivals curbside.

- **Option 1: Combine Domestic and International Arrivals –** This option moves private vehicle pick up for international arrivals to the domestic arrivals curbside. The peak period curbside activity collected in the ground transportation surveys was reviewed to determine if the domestic arrivals curbside could accommodate the increased international arrivals traffic. The international arrivals peak occurs at 6:15 a.m. while the domestic arrivals peak occurs at 8:45 p.m. The resulting overlapping peak would also occur at 6:15 a.m. Based on the forecast curbside activity, the domestic arrivals curbside was estimated to have sufficient capacity to accommodate both domestic and international activity through PAL 1. By PAL 3, the resulting deficiency would only be 125 feet, assuming increased enforcement and only active vehicle loading on the curbside. Once private vehicles were moved off the curbside the space could be reconfigured for all or a portion of commercial vehicle use, such as accommodating the planned new express bus and BRT service. The relocation of international arrivals pick-up would require arriving international passengers to circulate up one level to the domestic terminal arrivals once they exit the FIS facility located on the same level as the international arrivals curbside.

- **Option 2: Reconfigure International Arrivals Curbside** – This option, presented on Figure 6-12, reallocates the international arrivals curbside to provide additional space for private vehicle pick up activity. The north end of the wall around the CBP and Delta Dash Cargo parking area will be relocated to lengthen the curbside. The TSA and CBP parking along the curbside will also be relocated with the employee shuttle pick-up area moved to the northern end of the curbside. This will provide a total of 455 feet for private vehicle pick up with an additional 40 feet for the employee shuttle, resulting in 495 feet of total linear curbside.

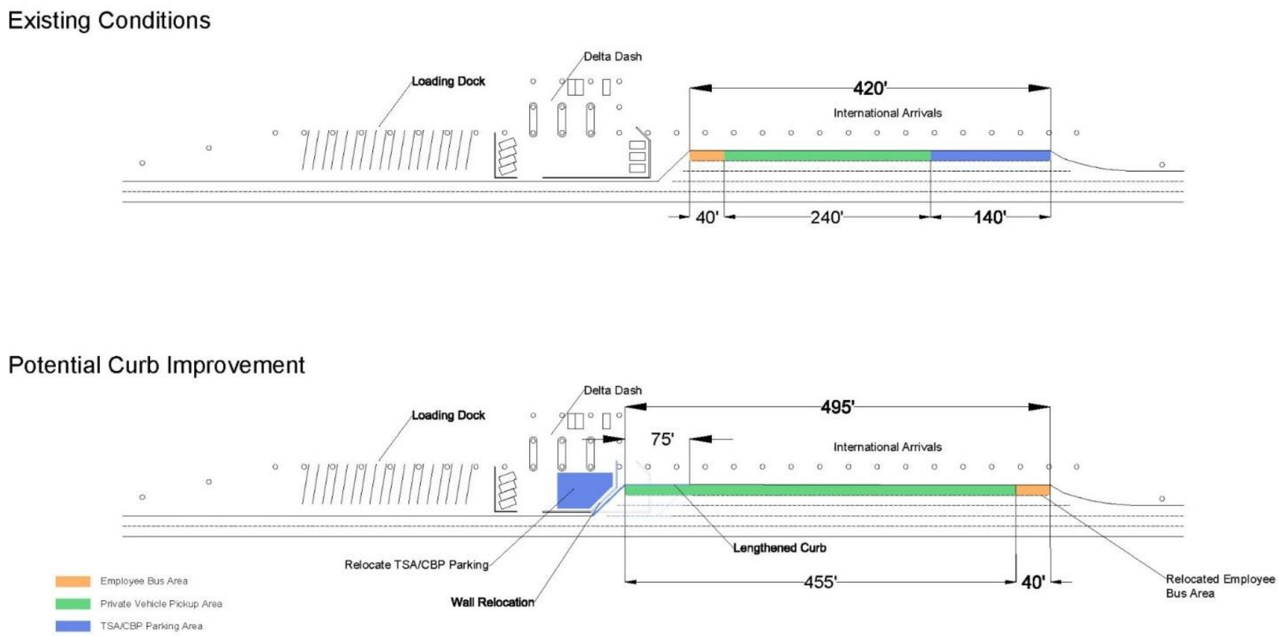
Both alternatives were reviewed by WCAA and the CAC and TAC stakeholder groups and both accommodated international arrivals vehicle activity significantly better than existing operations. However, the inconvenience to arriving international passengers, who tend to travel with more luggage, caused by requiring a level change to access the private vehicle curbside after exiting the FIS facility resulted in the elimination of Option 1.

6.2.2.3 McNamara Terminal Ground Transportation Center

The existing McNamara Terminal GTC is located within the McNamara Parking structure adjacent to the international arrivals curbside, on the lowest of three curbside roadway levels. The curbside is configured with hotel and parking shuttle zones on the northern section of curb, taxi pick-up adjacent to the GTC building and rental car shuttle zones on the southernmost section of curb. Currently, the GTC has a 240-foot deficit in curbside length and with a reduction of rental car dwell times to reflect active loading and unloading; this deficit is reduced to 100 feet but increases to 210 feet by PAL 3. The location within the parking structure makes it challenging to reconfigure or expand.

Three options were reviewed to increase the capacity for commercial vehicle operations at the McNamara Terminal.

Figure 6-12
RECOMMENDED RECONFIGURATION OF INTERNATIONAL ARRIVALS CURBSIDE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

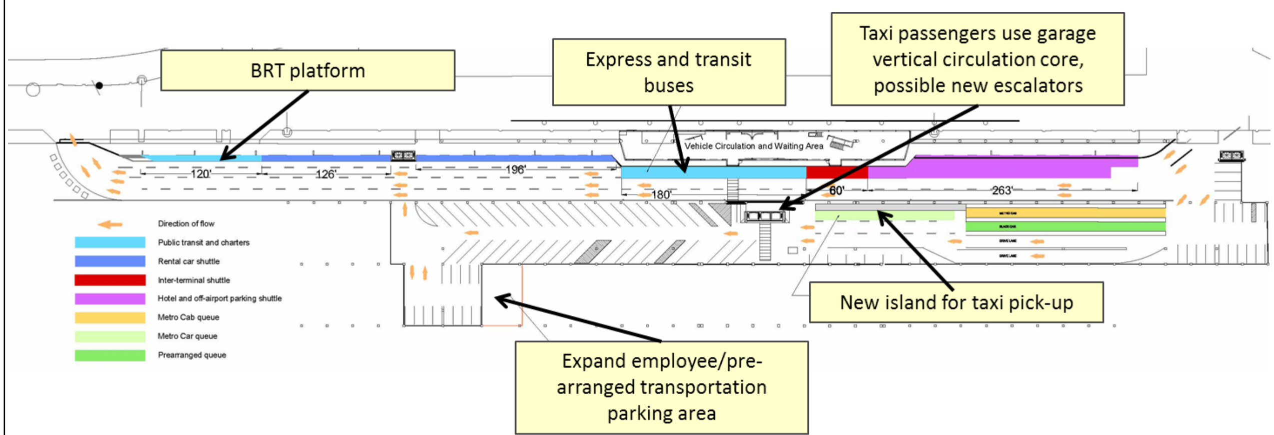


Source: HNTB.

- **Option 1: Relocate GTC to the International Arrivals curbside** – If the International Arrivals Curbside were vacated in as described above in the McNamara Terminal International Arrivals Curbside Option 1, all or a portion of commercial vehicle activity could be relocated to the area remaining. In order to accommodate all of the GTC activity the McNamara Terminal landside loading dock would require relocation. However, if commercial vehicle activity were split between the existing GTC and International Arrivals curbside the dock could remain. As McNamara Terminal International Arrivals Curbside Option 1 was eliminated, this concept was not carried forward.

- **Option 2: Taxi Pick-up in the Garage** – Option 2, shown on Figure 6-13, provides additional curb space by constructing a new median island within the garage for queuing and loading taxi passengers. The new island is located just beyond the taxi queues within the garage and taxi customers directed through the garage to the far side of the commercial curb and then down the existing vertical circulation core in the garage, rather than down into the GTC as they are today. New escalators could be provided to enhance the experience. Pre-arranged transportation parking which occurs in this area would be moved north within the garage to an expanded parking area. This would result in the loss of approximately 26 public parking spaces. The area used today for taxi pick up adjacent to the GTC building will be reconfigured for planned local and express bus service. A dedicated Bus Rapid Transit platform will be provided at the south end of the curb adjacent to the rental car zone. Rough order of magnitude costs for the reconfiguration of the parking area and construction of a taxi island and BRT platform are estimated at approximately $500,000, not including new escalators.

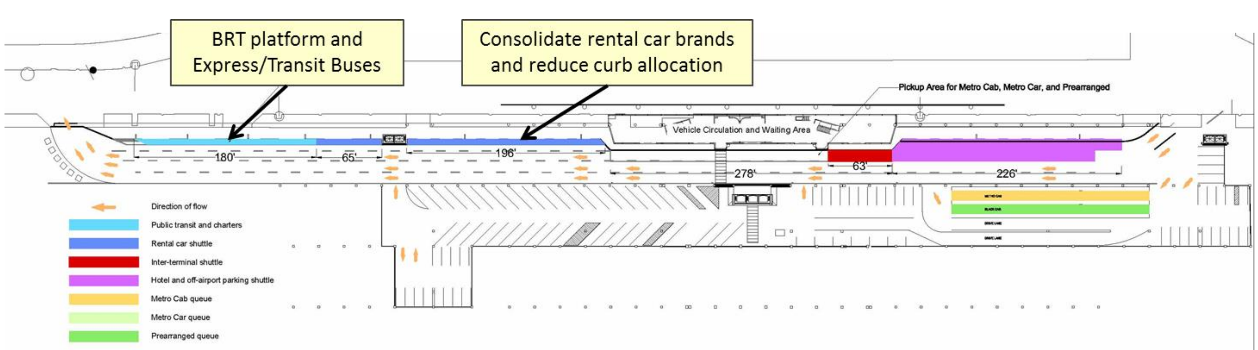
Figure 6-13
McNAMARA GTC OPTION 2 – TAXI PICKUP IN GARAGE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: HNTB.

- **Option 3: Reallocate Curbside Pick-up Zones** – Option 3, shown on Figure 6-14, focuses on accommodating increased demand through the reallocation of existing curb zones with minimal change to the physical infrastructure. The primary impetus for this option would be a consolidated rental car busing operation, which would reduce the space needed for rental car shuttles activity as the number of vehicles would be reduced. The space made available by the consolidation of rental car shuttles would be reallocated to create space for express and BRT zones, as shown on Figure 6-14. While this provides an increase in capacity during the short term, it does little to accommodate increased long-term capacity for commercial vehicle activity at McNamara Terminal. Rough order of magnitude costs are estimated at approximately $300,000 for the BRT platform.

Figure 6-14
McNAMARA GTC OPTION 3 – REALLOCATE CURBSIDE PICK-UP ZONES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



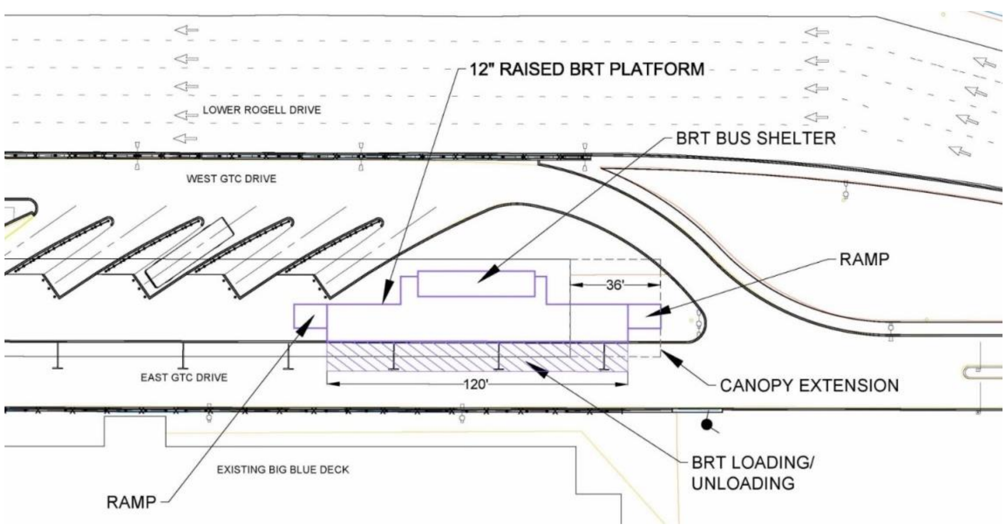
Source: HNTB.

All three options were reviewed by the Authority and the CAC and TAC stakeholder groups and all accommodate future BRT and express bus service. Option 1 was eliminated due to the reduction in passenger convenience and level of service caused by requiring all international arriving passengers to change levels to be picked-up. Of the two remaining options, Option 2 provides additional physical curbside capacity while Option 3 relies on operational changes in rental car operations to expand capacity on the curbside.

6.2.2.4 North Terminal Ground Transportation Center

While the GTC at the North Terminal is sufficiently sized to accommodate demand through 20-year planning horizon, new express bus and BRT service is planned and will need to be accommodated. A BRT loading platform is proposed at the north end of the GTC, as shown on Figure 6-15. Rough order of magnitude costs for the BRT platform are estimated at $400,000.

Figure 6-15
NORTH TERMINAL GROUND TRANSPORTATION CENTER
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: HNTB.

6.2.3 Public Parking

Public parking is accommodated in four primary facilities on the Airport: McNamara Garage, Big Blue Parking Deck, and Green Lots 1 and 2 which provide remote surface parking with shuttle service to the terminals. Additional public parking is provided by off-Airport private companies. Facility requirements show a current deficit of parking in both the McNamara and Big Blue Parking Deck of 500 and 300 spaces respectively. The Green Lots currently have a surplus of parking. By the end of the planning horizon, an additional 2,500 parking spaces will be required in both the McNamara Garage and Big Blue Parking Deck for a total deficit of 5,000 parking spaces. The Green Lots, which are located on the north side of the Airport, have the closest proximity to the North Terminal and are forecast to have sufficient capacity to accommodate demand through the planning horizon. These estimates are based on the current parking rate structure. Changes to the parking rates can influence demand and the choice of facilities. Changing rates is a form of demand management which can help balance demand among parking facilities and reduce the need for expensive infrastructure improvements. The alternatives discussed in this section focus on physical improvements to meet forecast demand.

6.2.3.1 Parking Garage Expansion

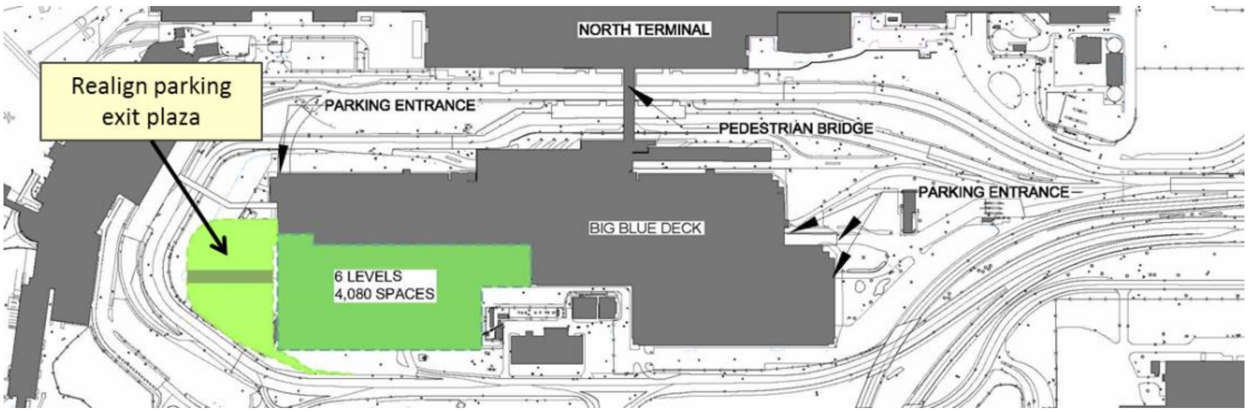
Currently, the majority of on-Airport parking is provided in the two parking garages with 9,413 spaces in the McNamara Garage and 6,164 spaces in the Big Blue Parking Deck. The Big Blue Parking Deck is located closest to the North Terminal but as it is priced lower than the McNamara Garage; some passengers park in this garage and take the inter-terminal shuttle to McNamara.

Three alternatives were reviewed to expand the capacity of structured parking at the Airport.

- **Alternative 1: McNamara Garage Expansion** – This alternative adds 700 spaces at the south end of the garage to address the shortage of parking at the McNamara Terminal which is currently 500 spaces but will grow to 2,500 by PAL 3. Due to development challenges, required relocation of adjacent access roadways and one of the garage helices, and airspace restrictions which limit the height of any expansion, this alternative was eliminated from further consideration. The limited number of parking spaces that could be developed was not warranted given the cost development challenges.
- **Alternative 2: Big Blue Parking Deck Full Expansion** – Alternative 2, shown on Figure 6-16, expands the Big Blue Parking Deck to the south east side of the existing garage. The full expansion provides approximately 4,080 additional parking spaces on four levels, close to the 5,000 total additional parking spaces required in PAL 3. Reconfiguration of the parking exit plaza and relocation of the parking revenue control equipment is required to accommodate the full expansion but the utility plant will remain. Rough order of magnitude costs for the full expansion are estimated at approximately $134 million.
- **Alternative 3: Big Blue Parking Deck Partial Expansion** – Alternative 3, a partial expansion of Alternative 2 shown on Figure 6-16, expands the Big Blue Parking Deck to the south east side of the existing garage, providing 2,000 additional spaces on four levels, providing most of the additional PAL 3 Big Blue Parking Deck space requirement. The partial expansion would not require reconfiguration of the parking exit plaza. Rough order of magnitude costs for the full expansion are estimated at approximately $67 million.

All alternatives were reviewed by the Authority and the CAC and TAC stakeholder groups. Alternative 1 was eliminated due to the limited expansion opportunity given the development and airspace challenges. Alternative 2 provides more parking than needed in the short- and medium-term but could be a potential longer term option. Alternative 3, the 2,000 space expansion, was recommended to be carried forward as it met the PAL 3 requirement for Big Blue Parking Deck requirements while minimizing impacts to surrounding infrastructure.

Figure 6-16
STRUCTURED PARKING ALTERNATIVES 2 AND 3 – BIG BLUE PARKING DECK EXPANSION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



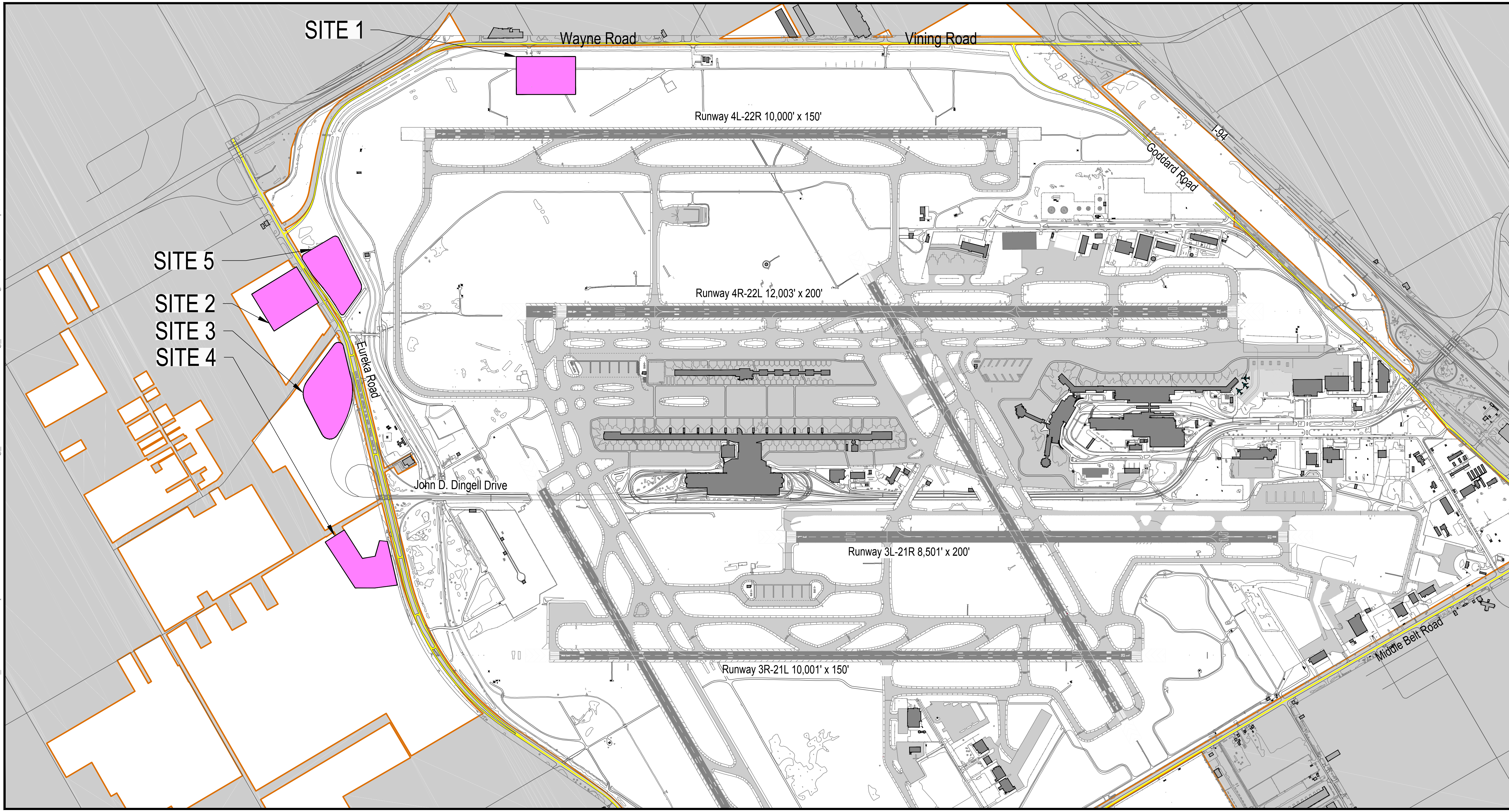
Source: HNTB.

6.2.3.2 Remote Surface Parking Expansion

While the future parking shortage is expected to be in structured parking, limited opportunities exist to expand the McNamara Garage on the south side of the Airport. As a result, opportunities for remote surface parking similar to the Green Lots on the north side were explored. Five potential sites on the south were identified and are shown on Figure 6-17. Each of the remote surface sites is approximately 14.7 acres in size, which would accommodate about 2,000 parking spaces. The sites could all be increased in the future to a range of 16.1 acres to 37.5 acres (2,200 spaces to 5,100 spaces). Sites 1, 2, and 4 provide the most expansion potential, at 4,700, 5,100, and 3,400 spaces respectively. Rough order of magnitude costs for these sites vary based on size and environmental mitigations required, but for the first phase 2,000 space facility are estimated at approximately $13 million.

Opportunity may exist in some portion of the north airfield complex to create additional surface parking beyond the Green Lot and Green Lot 2. However, no significant lands have been identified which are currently vacant. In addition, the Green Lots combined with a Big Blue Parking Deck expansion are projected to meet demand through the planning horizon for the North Terminal. As a result, no new north remote lots were identified to be carried forward.

A summary of each site is included in Table 6-6. Sites 3 and 5 have extensive wetlands throughout the site, complicating development while Site 2 has been identified for other potential development opportunities. Site 1 has no visibility from the Airport approach while Site 4 is located east of the Airport entrance out of the direct path of most of the passengers on approach to the Airport.



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LEGEND

- Proposed parking site
- Airport property line
- Airport perimeter roadways
- Off-airport property and airfield
- Airport facilities

NORTH

0 800' 1600' 3200'

Figure 6-17
ALTERNATE REMOTE SURFACES PARKING LOT SITES

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Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
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Table 6-6
SUMMARY OF REMOTE SURFACE PARKING LOT SITE CHARACTERISTICS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Site 1	Site 2	Site 3	Site 4	Site 5
Initial size shown	14.7 acres 2,000 spaces	14.7 acres 2,000 spaces	14.7 acres 2,000 spaces	14.7 acres 2,000 spaces	14.7 acres 2,000 spaces
Expansion potential	35 acres; 4,700 spaces	37.5 acres; 5,100 spaces	20.3 acres; 2,800 spaces	24.9 acres; 3,400 spaces	16.1 acres 2,200 spaces
Environmental / wetland Issues	No wetlands	Provide buffer to wetlands	Wetlands throughout site	Provide buffer to wetlands	Wetlands throughout site
Alternate development identified	No alternative uses identified	Identified for commercial development	No alternative uses identified	No alternative uses identified	No alternative uses identified
Visibility from Airport approach	No visibility	Good visibility from EB Eureka; known location	Good visibility from EB Eureka	Good visibility from EB Eureka but past Airport entrance	Good visibility from EB Eureka
Public accessibility	Longer routing; not direct from Eureka	Similar to cell lot; direct from EB Eureka	Similar to cell lot; direct from EB Eureka	Direct from EB Eureka but past Airport entrance	Direct from WB Eureka
Connection to terminals	Longer shuttle route than other options	Direct connection to inbound Airport roadway; requires U-turn for access to lot	Direct connection to inbound Airport roadway; requires U-turn for access to lot	Direct connection from outbound Airport roadway; requires U-turn for Airport access	Direct connection from outbound Airport roadway; requires U-turn for Airport access

Source: HNTB, October 2016.

All sites were reviewed extensively by the Authority and the CAC and TAC stakeholder groups. The screening criteria is depicted in Table 6-7 and based on Negative (-), Neutral (0), and Positive (+) scores for each category. The higher the positive score, the greater the zone performs against the evaluation criteria.

Site 2 most closely meets the criteria for evaluating the remote surface parking sites. Sites 3 and 5 have wetland issues that would require mitigation prior to development. Site 4 is located east of John D. Dingell Drive along Eureka Road providing less visibility to inbound Airport traffic. Site 1 is located west of the airfield and has the least visibility and accessibility of all the sites as it is not located along Eureka Road. Sites 2 and 3 score the strongest and have good accessibility but Site 2 can be developed without impacting the wetlands which is a significant benefit.

Table 6-7
REMOTE SURFACE PARKING EVALUATION MATRIX
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Site 1	Site 2	Site 3	Site 4	Site 5
Expansion potential	+	+	0	+	-
Environmental / wetland Issues	+	0	-	0	-
Alternate development identified	+	-	+	+	+
Visibility from Airport approach	-	+	+	-	+
Public accessibility	-	+	+	0	0
Connection to terminals	-	+	+	0	0
Total	0	3+	3+	1+	0

Source: HNTB, October 2016.

6.2.4 Employee Parking

Employee parking is currently provided in the South Employee Lot, the McNamara Garage for McNamara employees, the Big Blue Parking Deck for North Terminal Employees and the Smith Terminal for employees working at the Smith Building and administrative offices. When the administration building is opened at the North Terminal, parking for employees from the Smith Terminal moving to the new offices will be relocated to the Big Blue Parking Deck closer to the Administration Building. In order to make room for public parking in the Big Blue Parking Deck, a new North Lot is being constructed along Goddard Road west of the maintenance facilities. This lot will be able to accommodate 1,744 spaces which will accommodate all Big Blue Parking Deck, former Smith Terminal and the growth in employee parking through the planning horizon.

6.2.5 Rental Car Facilities

Individual rental car sites are currently located along Lucas Drive North of the Terminals with primary access provided from Middlebelt Road at Lucas Drive for customers arriving from I-94 east or west of the Airport. Secondary access is provided from W. G. Rogell Drive at Burton Drive with access to Lucas Drive from the East Service Drive. Shuttles to the terminals are run by individual rental car companies. Considerable consolidation of within the rental car industry has occurred in recent years and while consolidated companies still operated under separate brand names, offering alternative levels of customer product and service, they are owned and operated by four primary companies. The brand families are Enterprise; Hertz, Dollar and Thrifty; Avis, Payless and Budget; and Alamo and National. At the Airport, facilities such as Budget/Payless and Avis are located at opposite end of Lucas Drive while Hertz and Dollar/Thrifty are across Lucas Drive from one another. These brands share office space and some vehicle cleaning and maintenance facilities; however, if facilities for brands operated by the same company were located closer together additional economies of scale could be realized with greater sharing of washing, fueling and maintenance facilities. The Authority is conducting a separate study outside of the Master Plan, the Rental Car Facility Improvement Project, to review the potential consolidation and reconfiguration of the existing rental car sites. This study determined that a consolidated rental car facility would not be warranted in the near- or mid-term and is focusing on the redevelopment of individual facilities.

The following two sites for future rental car development were provided by the Authority for evaluation in this Master Plan:

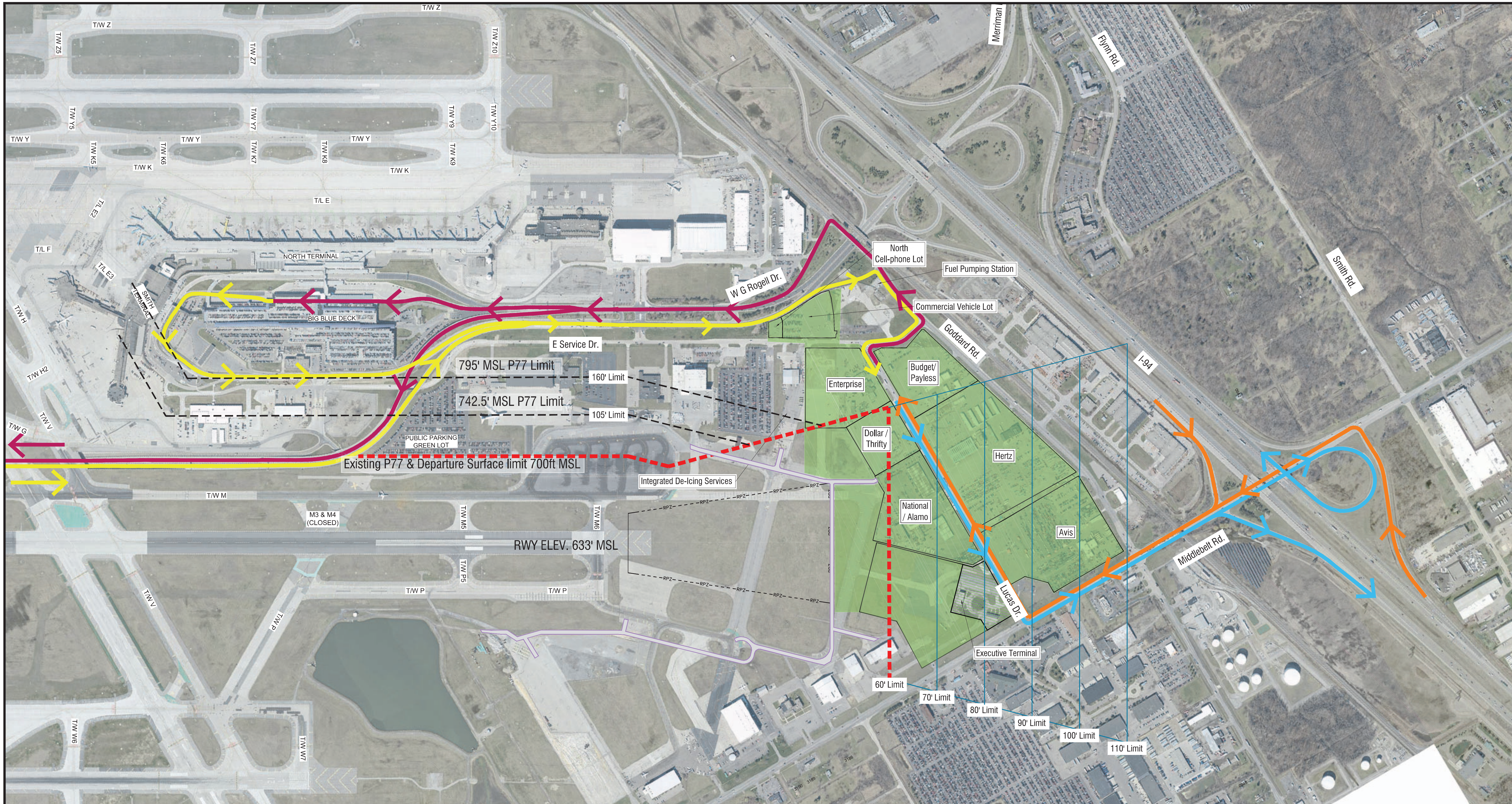
- **Zone 1** – Rental car facilities remain in their existing location along Lucas Drive with potential reconfiguration (see Figure 6-18).
- **Zone 2** – Rental car facilities move across I-94 along Smith Road (see Figure 6-19).

A summary of Zone 1 and 2 is included in Table 6-8.

Table 6-8
FUTURE RENTAL CAR DEVELOPMENT ZONE SUMMARY
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Existing conditions	Zone 1: Reconfigure Existing Location	Zone 2: Relocate North of I-94
Size / requirements	68 acres	81 acres	69 acres
Coordination/permitting	N.A.	Limited coordination outside the Authority	Coordination with City of Romulus / Michigan Department of Transportation
Development challenges	Constrained sites with old infrastructure	Requires removal / phasing of existing infrastructure	Requires property acquisition, removal of existing infrastructure and new utilities
Accessibility	Primary access from Middlebelt and Lucas Drive	Customer access could be similar to today's operations	Potential for direct access from I-94 and Middlebelt interchange
Terminal shuttles	3:45 min to North Terminal 7 min to McNamara Terminal	Same or better than today	Worse than today

Source: HNTB, October 2016.



LEGEND

Rental car zone 1	Shuttle access to rental car facility
Approx. 60 ft high building limit line	Shuttle access to terminals
Part 77 building limit line	Vehicle access to rental car facility
Runway protection zone	Vehicle access to terminals
Future airfield service road reconfiguration	

T/L Taxilane
T/W Taxiway

NORTH

0 800' 1600' 3200'

Figure 6-18
RENTAL CAR ZONE 1

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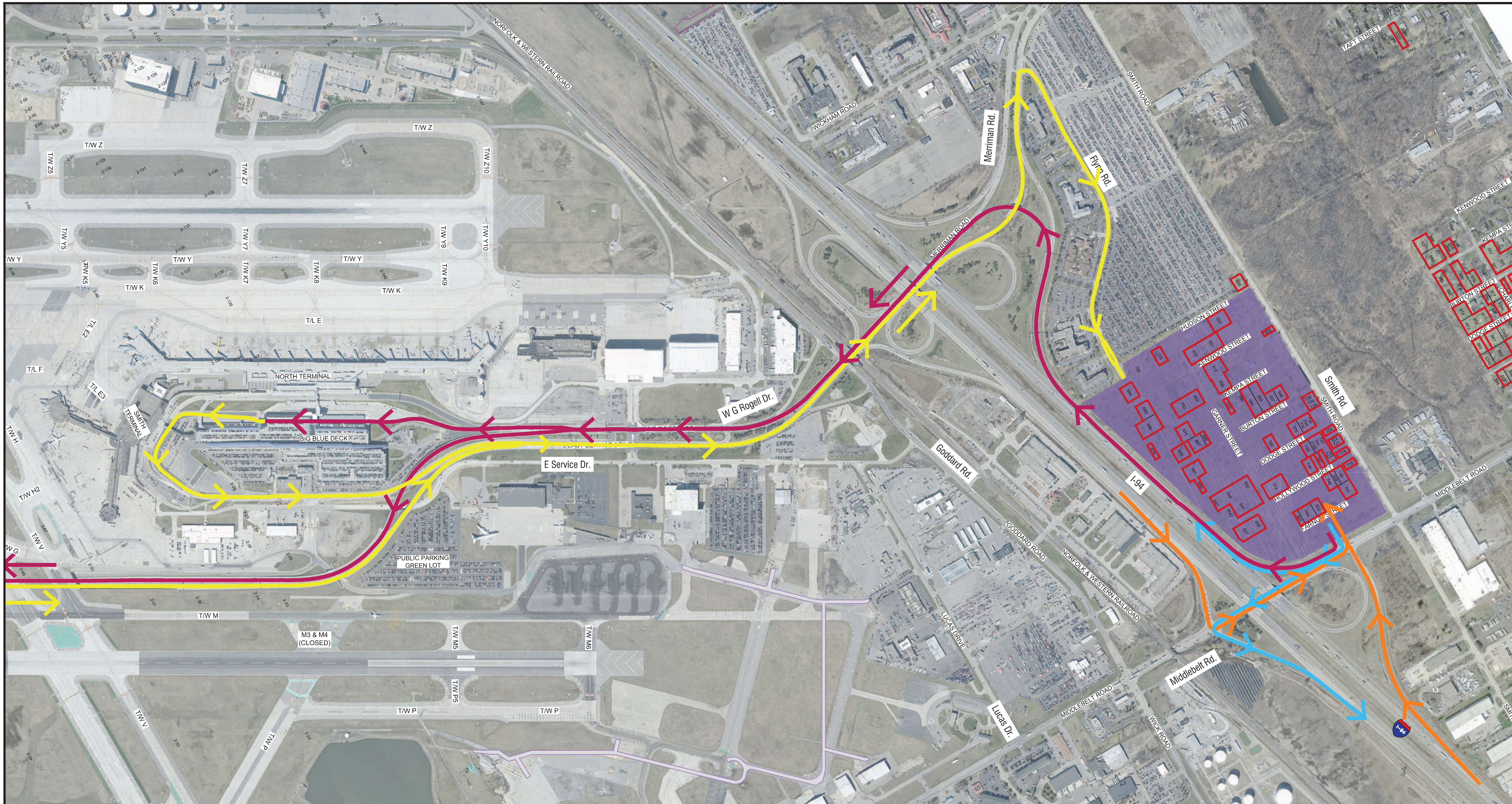

LEGEND

- Rental car zone 2
- Shuttle access to rental car facility
- Shuttle access to terminals
- Vehicle access to rental car facility
- Vehicle access to terminals

T/L Taxilane

T/W Taxiway

NORTH

0 800' 1600' 3200'

Figure 6-19
RENTAL CAR ZONE 2

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Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
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Zone 1 maintains rental car facilities in their current location along Lucas Drive with individual facility configuration determined in the separate Rental Car Facility Improvement Project. Customer access to this location would continue to be provided from Middlebelt Road to Lucas Drive with secondary access from W. G. Rogell Drive at Burton Drive with access to Lucas Drive from the East Service Drive, while rental car shuttle service to the terminals would remain the same as today. The height restrictions for development of new facilities are shown on Figure 6-18, with the 60 foot building limit line defined by the existing Part 77 and departure surface. As shown, the majority of the zone can accommodate buildings higher than 60 feet. The future planned realignment of the Runway 21L service road around the RPZ allows additional area for expansion south of the Lucas Drive. In addition, the area around the Executive Terminal and the area north of the East Service Drive, once the commercial vehicle hold lot is relocated, could be used in the future for rental car facility expansion providing a total of 81 acres, meeting requirements through PAL 1. Reconfiguration of facilities to better utilize space could also reduce the area required and meet requirements through PAL 2 and beyond.

Zone 2 is located north of I-94 off of Middlebelt Road, between Smith Road and I-94. Primary customer access would be provided from Middlebelt Road, possibly with direct access from the I-94 westbound off-ramp. Rental car shuttles would access the terminal via Flynn Road to Merriman Road which becomes W. G. Rogell Drive south of I-94. This zone provides 69 acres for development, similar to the existing rental car area; however, a strip of property along the south boundary of the zone has been identified for potential future development which could reduce the available area. Although the Authority owns a number of parcels on this zone, shown on Figure 6-19, additional property acquisition would be required prior to development. In addition, development of all new rental car facilities and construction of new utilities would be necessary on this greenfield site. Coordination with the City of Romulus and the Michigan Department of Transportation would be required with Smith Road, adjacent to the zone, potentially requiring upgrades as the pavement is in poor condition.

Both zones were reviewed extensively by the Authority and the CAC and TAC stakeholder groups. The screening criteria is depicted in Table 6-9 and based on Negative (-), Neutral (0), and Positive (+) scores for each category. The higher the positive score, the greater the zone performs against the evaluation criteria.

Zone 1 more closely meets the criteria for evaluating the potential rental car development areas. Zone 2 requires property acquisition prior to development and requires a complete reconstruction of all rental car facilities to the north side of I-94 which lengthens the shuttle route adding additional time and uncertainty to the operations due to the potential for traffic at the I-94 and Merriman Road interchange to negatively impact traffic. The proximity of Zone 1 to the terminals, existence of existing facilities and infrastructure, limited coordination with agencies outside of the Authority and the potential for additional expansion area were considered significant benefits to Zone 1.

Table 6-9
RENTAL CAR ZONE EVALUATION MATRIX
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Zone 1: Remain in Existing Location	Zone 2: Relocate North of I-94
Size / requirements	+	0
Coordination / permitting	+	-
Development challenges	+	-
Accessibility	0	+
Terminal shuttles	0	-
Total score	3+	2-

Source: HNTB, October 2016.

6.3 AIRPORT MAINTENANCE COMPLEX ALTERNATIVES

As documented in Chapter 5, the Airport's existing Maintenance Complex will require expansion and upgrades to meet future Airport maintenance needs. The following conceptual alternatives were identified, considered, and assessed in conjunction with Authority staff and members of the PSC.

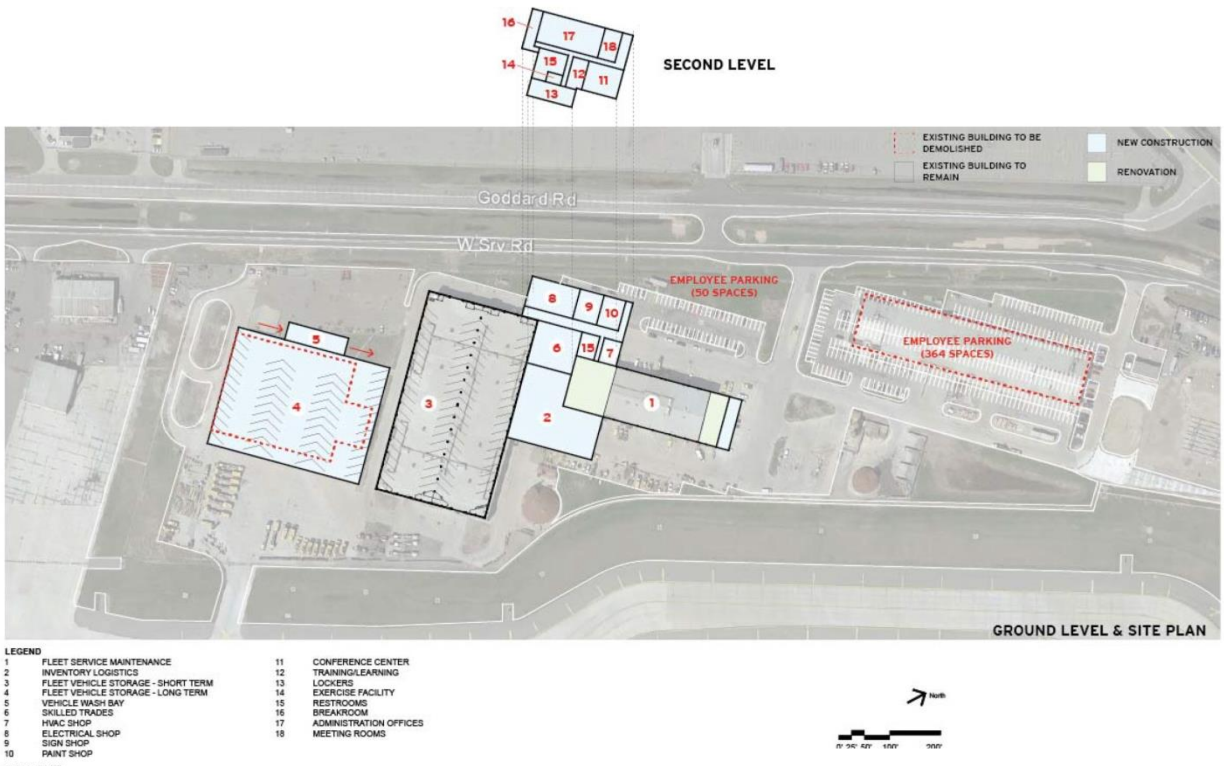
- **Building 704/705 Infill** – As shown on Figure 6-20 is a two-story infill solution, which connects the existing fleet services building (704), with storage/service building (705) and maintains quick/easy Airside gate access, close proximity to the new fueling station, and utilizes the existing site infrastructure to serve the new construction. Several building code obstacles that could significantly increase costs as well as a limited footprint to meet the space program were identified.

- **North Parking Lot** – All new construction on an open site (existing parking lot) across West Service Road/Goddard Road. There are potential conflicts with the existing gas line, TERPS, and access to site utilities to feed the new building. The location is considerably further away from the AOA gate for quick airside access and would require additional infrastructure (roadways, utilities) to serve the buildings.

- **Building 703 Infill** – A single story addition/renovation to the Administration/Maintenance building (703) and a new Short/Long Term Vehicle storage building that allows the Fleet Services Maintenance to be physically connected to Inventory Logistics Center. The new Short/Long Term Vehicle storage building is located adjacent to Maintenance/Logistics/Admin Building and maintains the quick and easy airside gate access. Several alternatives of this scheme were studied. Alternatives 3A and 3B are illustrated on Figure 6-21.

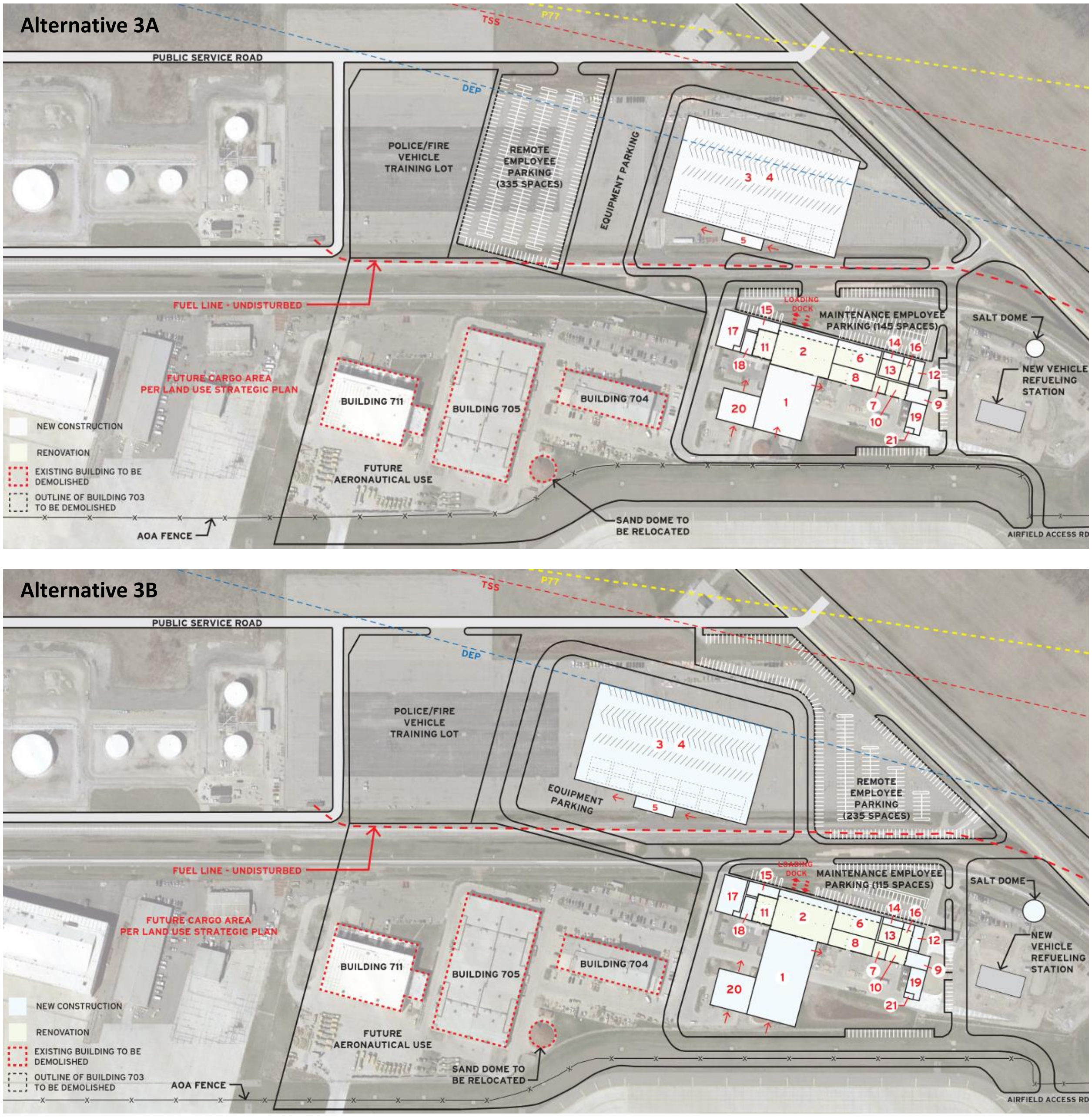
- **Middlebelt/Hildebrandt Street** – All new construction on the east side of the Airport, which would require demolition of existing hangers and service buildings, as shown on Figure 6-22. The Fleet Service Maintenance and Inventory Logistics Center are grouped together with a separate Short/Long Term Vehicle storage building just adjacent with easy access. However, due to the site restraints, some program adjacencies are not met with the Fleet Service Maintenance layout. This site is also not adjacent to new fueling facility.

Figure 6-20
BUILDING 704/705 INFILL ALTERNATIVE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: HNTB, October 2016.

Figure 6-21
703 INFILL SCHEME – ALTERNATIVES 3A AND 3B
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

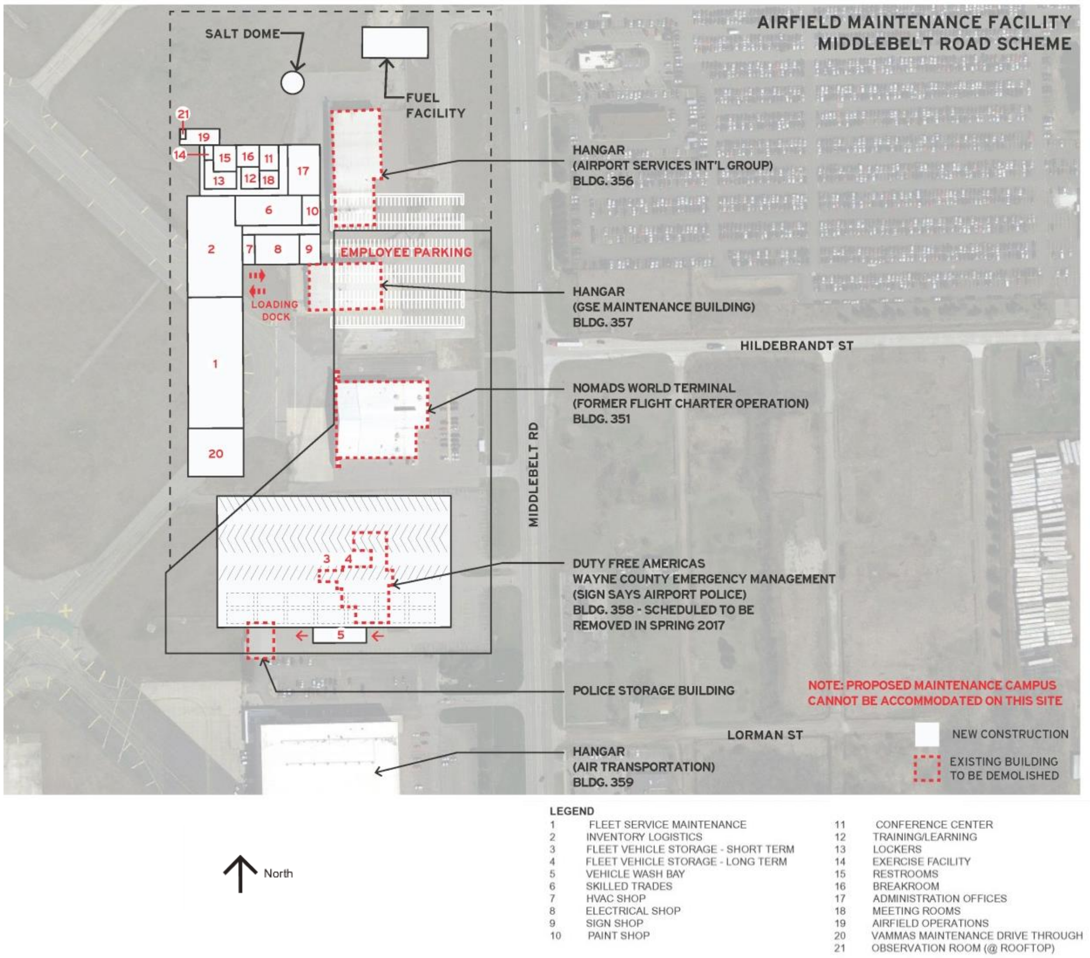


LEGEND

1 FLEET SERVICE MAINTENANCE
2 INVENTORY LOGISTICS
3 FLEET VEHICLE STORAGE - SHORT TERM
4 FLEET VEHICLE STORAGE - LONG TERM
5 VEHICLE WASH BAY
6 SKILLED TRADES
7 HVAC SHOP
8 ELECTRICAL SHOP
9 SIGN SHOP
10 PAINT SHOP
11 CONFERENCE CENTER
12 TRAINING/LEARNING
13 LOCKERS
14 EXERCISE FACILITY
15 RESTROOMS
16 BREAKROOM
17 ADMINISTRATION OFFICES
18 MEETING ROOMS
19 AIRFIELD OPERATIONS
20 VAMMAS MAINTENANCE DRIVE THROUGH
21 OBSERVATION ROOM (@ ROOFTOP)

Source: HNTB, October 2016.

Figure 6-22
MIDDLEBELT/HILDEBRANDT STREET ALTERNATIVE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: HNTB, October 2016.

- **Middlebelt/Northline Road** – New construction on a greenfield site. The Fleet Service Maintenance and Inventory Logistics Center are grouped together with a separate Short/Long Term Vehicle storage building just adjacent with easy access. However, this site is not adjacent to new fueling facility and would require additional costs to extend utilities to the campus.

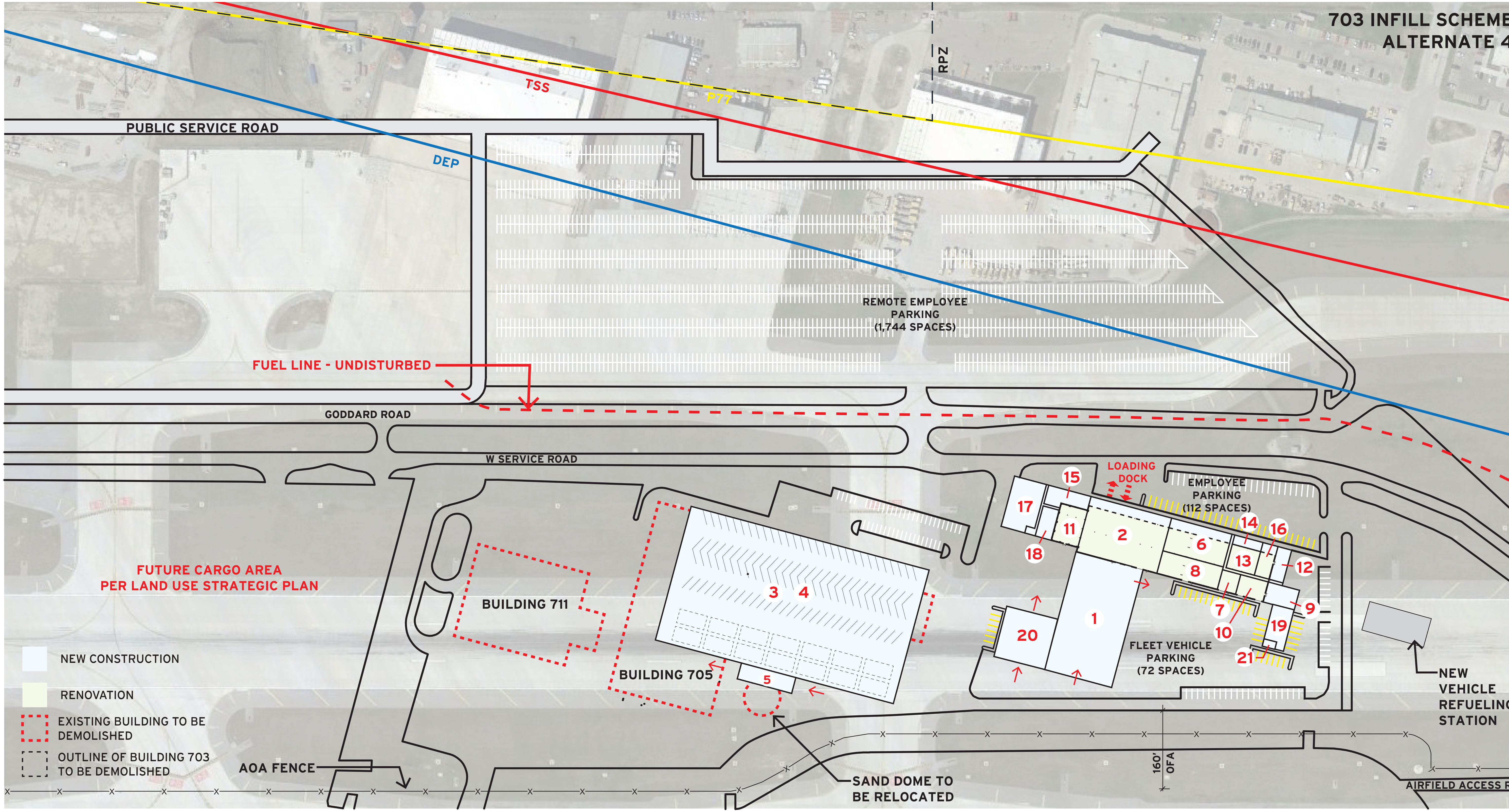
- **Wayne Road** – New construction on a greenfield site. The Fleet Service Maintenance and Inventory Logistics Center are grouped together with a separate Short/Long Term Vehicle storage building just adjacent with easy access. However, this site is not adjacent to a new fueling facility and would require additional costs to extend site utilities to the campus. It is also situated in a remote south location, which would require additional time to access taxiways.

The above Airport maintenance facility alternatives were evaluated against the following factors:

- Cost
- Ability to quickly respond to different parts of the airfield during major snow events
- Impact on land that needs to be available in the future with proximity to the airside
- Impact on existing or future needs for landside facilities such as public or employee parking

Based on the evaluation and input provided by PSC staff – the Building 703 Infill scheme was chosen as the preferred alternative, with the refined version depicted on Figure 6-23. The refined preferred scheme also allows the North Parking lot area to be fully paved providing 1,700 additional parking spaces, as shown on the figure.

In addition, a new maintenance satellite facility will be constructed on the southeast end of the Airport campus for use on a seasonal basis to increase operational efficiencies of field maintenance and airfield operations during snow removal and emergency procedures. This new 2,000 square foot building will be located in the vicinity of Superior and Middlebelt roads and depicted on the Airport's Future ALP, as well as Figure 6-24.



LEGEND

1	FLEET SERVICE MAINTENANCE	11	CONFERENCE CENTER
2	INVENTORY LOGISTICS	12	TRAINING/LEARNING
3	FLEET VEHICLE STORAGE - SHORT TERM	13	LOCKERS
4	FLEET VEHICLE STORAGE - LONG TERM	14	EXERCISE FACILITY
5	VEHICLE WASH BAY	15	RESTROOMS
6	SKILLED TRADES	16	BREAKROOM
7	HVAC SHOP	17	ADMINISTRATION OFFICES
8	ELECTRICAL SHOP	18	MEETING ROOMS
9	SIGN SHOP	19	AIRFIELD OPERATIONS
10	PAINT SHOP	20	VAMMAS MAINTENANCE DRIVE THROUGH
		21	OBSERVATION ROOM (@ ROOFTOP)

North

0 25 50 100 200

Figure 6-23

703 BUILDING INFILL
MAINTENANCE FACILITY ALTERNATIVE
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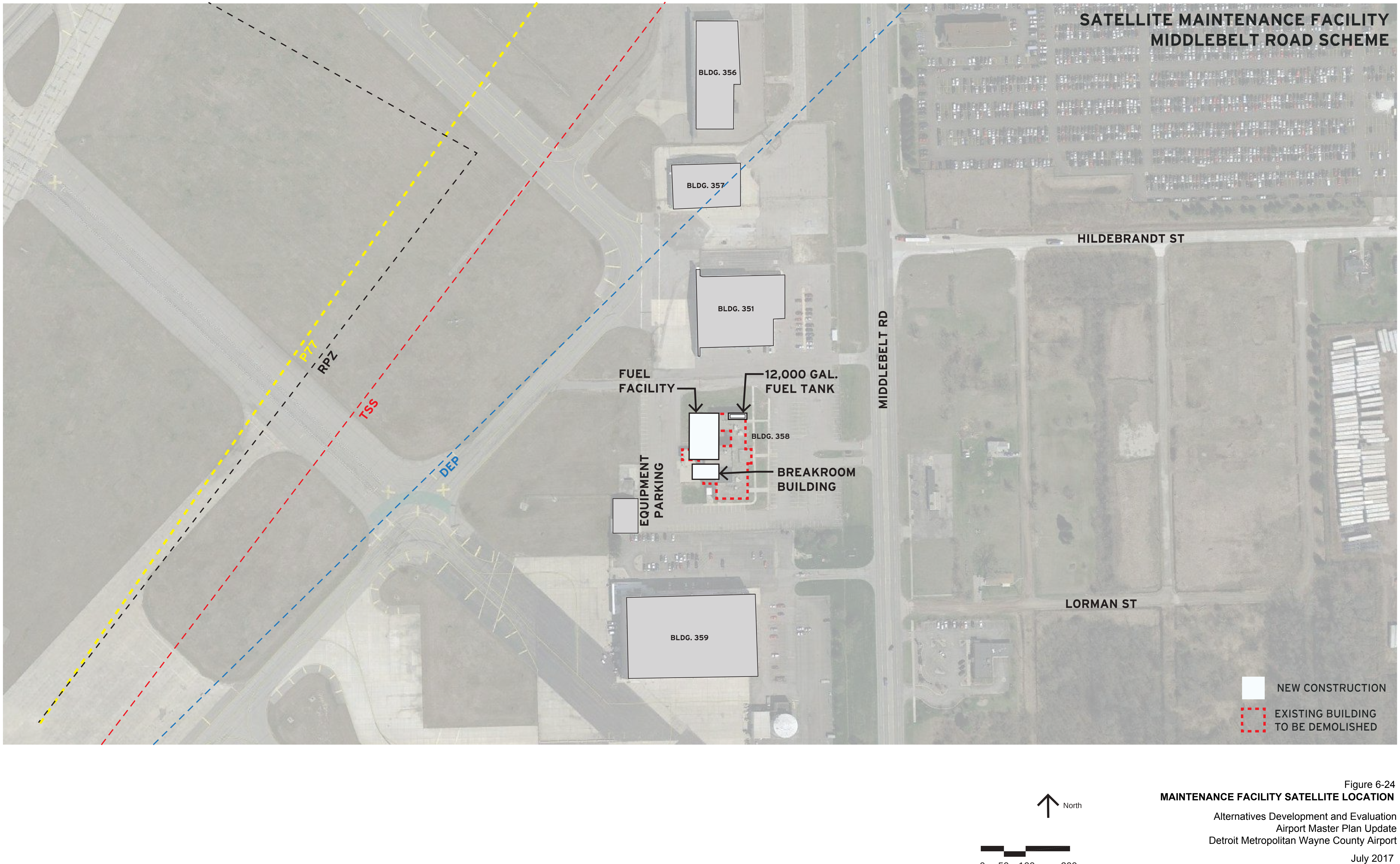


Figure 6-24
MAINTENANCE FACILITY SATELLITE LOCATION

Alternatives Development and Evaluation
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

July 2017

LeighFisher

6.4 OTHER DEVELOPMENT ALTERNATIVES CONSIDERED

This section describes the identification and evaluation of additional development alternatives that were considered in the master planning process. Development alternatives considered herein will not be recommended for implementation on the Recommended Development Plan nor depicted on the Future ALP. Rather, the options are being documented for potential reconsideration in future planning endeavors.

6.4.1 McNamara Terminal

Facility requirements indicated that no additional contact gates are required at the McNamara Terminal throughout the 20-year planning period. However, three additional narrowbody and two additional widebody RON parking positions are required by 2035. RON parking alternatives are addressed in Section 6.2, Airfield Alternatives. The aircraft gate analysis is summarized in Section 5.3.2.

Among the three functional elements analyzed in the McNamara Terminal space requirements: check-in, SSCPs, and FIS facilities, only security screening indicated deficiencies in overall space demand by the end of the planning horizon.

6.4.1.1 Passenger Security Screening Checkpoints

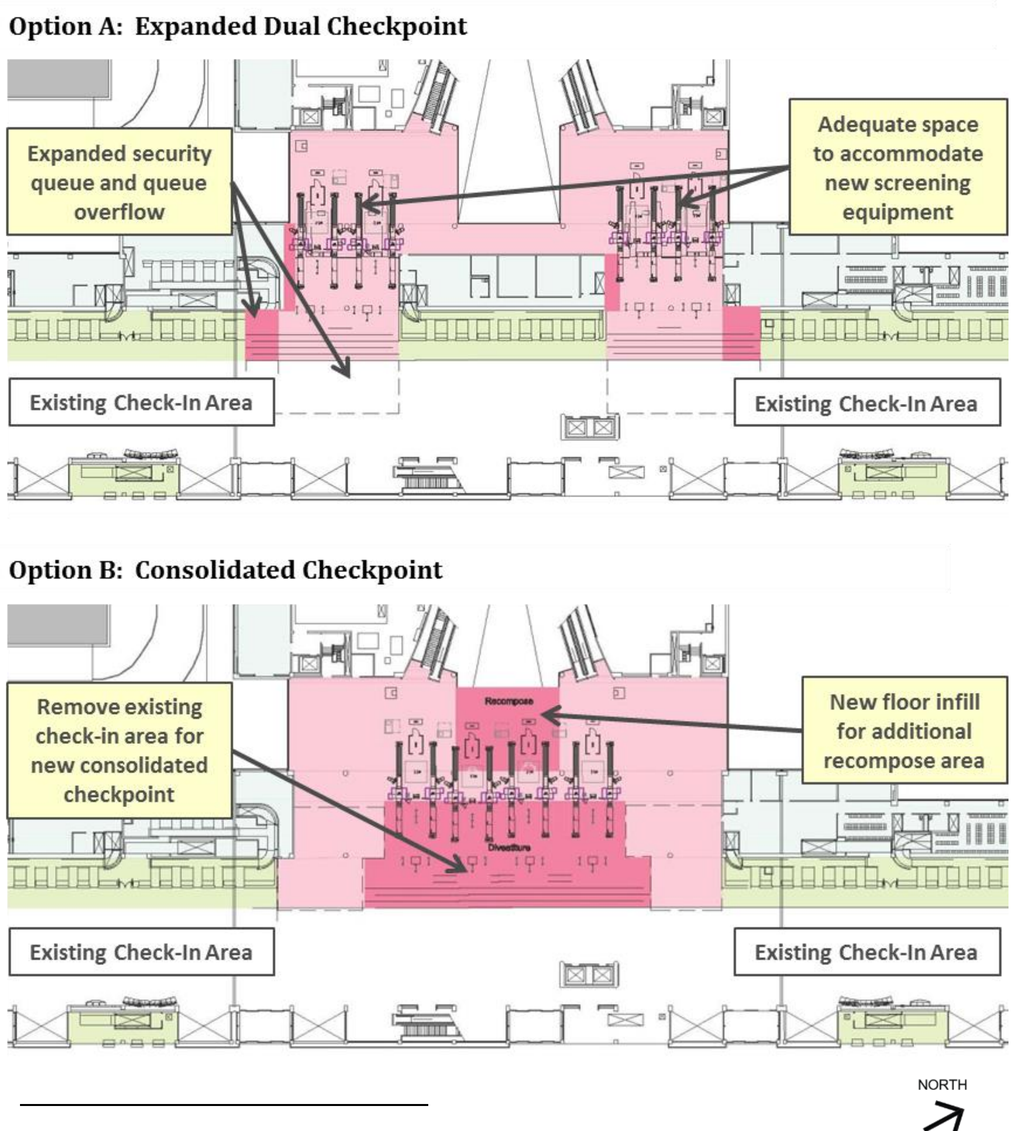
Two primary passenger SSCPs are located adjacent to the Check-in area on Level 3, one to the north and one to the south with five screening lanes each. These two Level 3 checkpoints are sufficient to accommodate 20-year demand. However, future security screening footprints are anticipated to be wider and longer, as illustrated by the latest TSA Automated Screening Lane technology, which increases divestiture space requirements by approximately 30%. Development of future checkpoints should accommodate the additional areas needed for screening, queuing, and support functions.

Two checkpoint options were developed to address increased space demands – an expanded dual checkpoint and a consolidated checkpoint, as illustrated on Figure 6-25.

Option A retains independent passenger security screening operations at both the north and south checkpoints on Level 3. Additional space is provided at each end to accommodate the wider and longer security screening equipment, passenger queuing and TSA support space requirements. The rough order of magnitude cost for this alternative is estimated at $2.3 million, including hard and soft costs with a 10% construction contingency.

Option B requires removal and relocation of the central check-in counters currently reserved for premier passengers. In addition, approximately 1,900 square feet of floor area in-fill is needed between the two down escalators from Level 3 security screening to Level 2 concourse to provide for an expanded recompose area downstream of security screening. This allows for the security screening lanes to be consolidated in the center to provide for a more efficient screening operation and available space on both the north and south ends to accommodate future lane expansion. The rough order of magnitude cost for this alternative is estimated at $4.2 million, including hard and soft costs with a 10% construction contingency.

Figure 6-25
McNAMARA TERMINAL CHECKPOINT OPTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



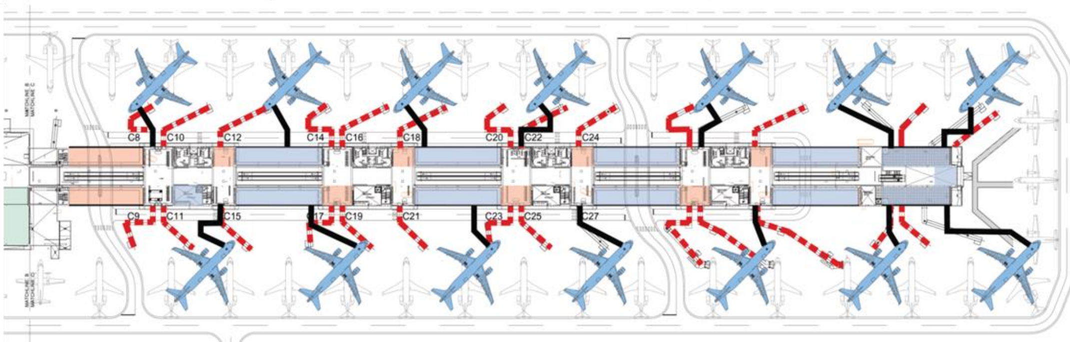
Source: LeighFisher, November 2016.

6.4.1.2 Long-term Concourse C Expansion Options

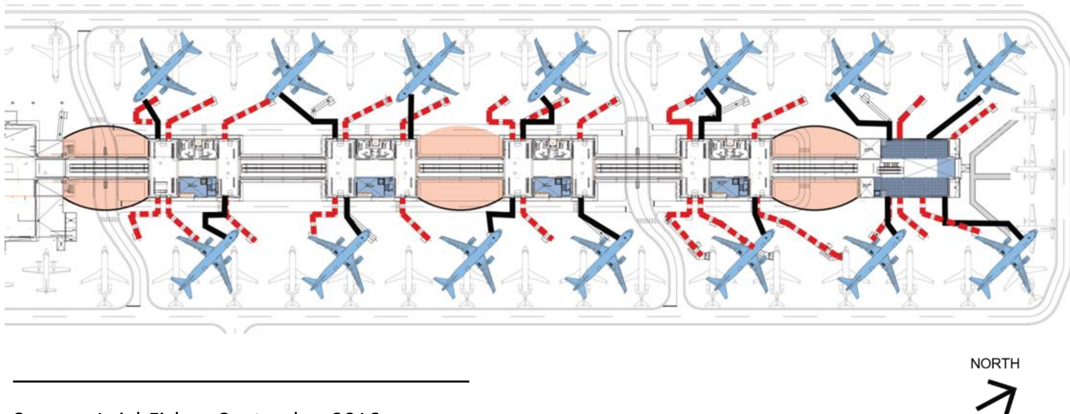
At a July 2016 McNamara Terminal Subcommittee meeting, Delta Air Lines suggested potential development options at Concourse C to reactivate approximately 15 underutilized regional jet gates to accommodate future ADG-III aircraft (i.e., RJ900s and B717s). This would require expansion of the holdrooms, passenger boarding bridges, concessions area, and reconfiguration of apron striping. As illustrated on Figure 6-26, two long-term expansion options were developed for Concourse C.

Figure 6-26
McNAMARA TERMINAL LONG-TERM CONCOURSE C EXPANSION OPTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Option A: Fill-in and Expand Hold Rooms



Option B: Relocate Concession Space to New Nodes



Source: LeighFisher, September 2016.

Option A adds new holdroom space at four different nodes by expanding building footprint as shown in blue. A total of approximately 43,000 square feet of holdroom area is being provided with this option along with concession areas that are being added near Gates C8 and C9, as shown in orange, and distributed throughout the concourse. This option also requires relocation and reconfiguration of passenger boarding bridges as well as restriping of aircraft lead-in lines to accommodate up to 14 ADG-III aircraft. The rough order of magnitude cost for this alternative is estimated at $118 million, including hard and soft costs with a 10% construction contingency.

Option B increases building footprint at three nodes, as shown in orange, which represents a blend of holdroom/concessions space. A total of approximately 33,400 square feet of holdroom space will be provided with this option, which also requires relocation and reconfiguration of passenger boarding bridges as well as restriping of aircraft lead-in lines to accommodate up to 14 ADG-III aircraft. The rough order of magnitude cost for this alternative is estimated at $94 million, including hard and soft costs with a 10% construction contingency.

Table 6-10 indicates both Options A and B are comparable based on rough order of magnitude costs. According to ACRP Report 25 recommendations, a minimum of 2,560 square feet of holdroom space is required to accommodate each ADG-III gate. With 14 potential ADG-III gates at Concourse C, a total of 35,840 square feet of holdroom space is required. Option A would be more than sufficient to meet the requirement, with a surplus of 7,300 square feet of holdroom space to provide for other amenities and enhance customer experience. Option B, on the other hand, falls short by 2,500 square feet of holdroom space to meet the minimum requirement. If this option is selected for development, it could potentially reduce level of passenger service at the concourse.

Table 6-10
EVALUATION OF LONG-TERM CONCOURSE C EXPANSION OPTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Option A	Option B
Holdroom area		
Required (sf) *(a)*	35,840	35,840
Provided (sf)	43,110	33,380
Surplus/loss (sf)	*+7,300*	*-2,500*
Estimated ROM cost	$118 M	$94 M

(a) Assumes 2,560 sf of holdroom space is required per ADG-III gate. At 14 ADG-III gates, this calculates to a total of 35,840 sf.

Source: LeighFisher, November 2016.

6.4.2 North Terminal

The requirements analysis indicated that a total of 29 contact gates will be required by 2035. The three additional ADG-III gates that are currently being planned for at the north end, upon demolition of the Berry Terminal, will be sufficient to handle the 20-year gate demand at the North Terminal. A total of 16 ADG-III remote aircraft parking positions will be required by 2035. RON parking alternatives are addressed in Section 6.2, Airfield Alternatives. The aircraft gate analysis is summarized in Section 5.3.3.

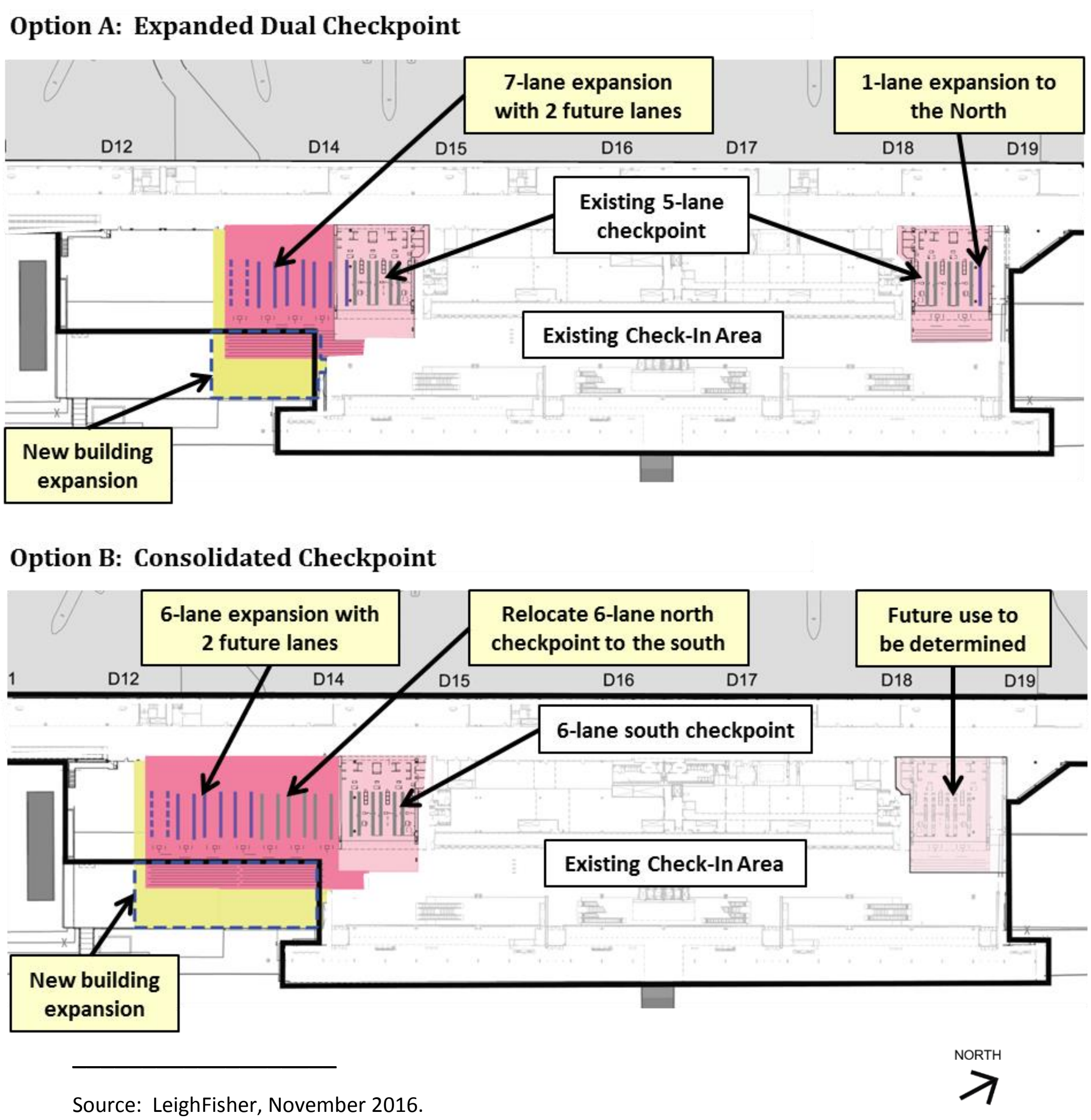
Among the three functional elements analyzed in the North Terminal space requirements – check-in, SSCPs, and FIS facilities – only security screening indicated deficiencies in overall space demand by the end of the planning horizon.

6.4.2.1 Passenger Security Screening Checkpoints

Two primary passenger SSCPs are located in the North Terminal check in lobby, one to the north and one to the south with five screening lanes each. These two checkpoints are insufficient to accommodate 20-year demand. Two additional lanes are already required at both the north and south checkpoints today. By 2035, a total of eight lanes will be required to meet passenger demands.

Two checkpoint options were developed to address increased demand – an expanded dual checkpoint and a consolidated checkpoint, as illustrated on Figure 6-27.

Figure 6-27
NORTH TERMINAL CHECKPOINT OPTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: LeighFisher, November 2016.

Option A retains the current dual checkpoint configuration on both the north and south banks. One lane will be expanded on the north for a total of six checkpoint lanes. On the south bank, seven additional lanes will be needed for a total of twelve lanes to accommodate the eighteen lanes that are required to meet 2035 demand. New building expansion will also be needed on the south to handle additional queue areas, public circulations, TSA support areas, and future screening lanes. No changes will be needed at the existing check-in area. This option imposes the least impact on current operations and can be implemented incrementally in the near-term. The rough order of magnitude cost for this alternative is estimated at $15 million, including hard and soft costs with a 10% construction contingency.

Option B proposes a consolidated checkpoint option by moving the six-lane north checkpoint to the south and expanding it to an eighteen lane checkpoint along with the associated building expansion to accommodate additional queue, public circulation and future checkpoint lanes. This option allows for more operational flexibility, queue management and could potentially reduce TSA staffing and administrative spaces. One downside is passengers on the north end of the concourse may have longer walking distances depending on where they enter at the terminal. The rough order of magnitude cost for this alternative is estimated at $27 million, including hard and soft costs with a 10% construction contingency.

6.4.2.2 Long-term Concourse Expansion Options

As illustrated on Figure 6-28, three long-term expansion options were identified for the North Terminal in the event actual demand exceeds forecast demand in the 20-year planning horizon.

Option A includes the addition of a single-loaded concourse on the south end with a bridge connector to the existing concourse. This provides a net gain of 7 ADG-III gates at the North Terminal with 1 ADG-V compatible position along the new concourse expansion. Assuming the future 22L deicing pad will be in place southwest of the new concourse, the remaining apron will be able to accommodate 5 ADG-III remain overnight parking (RON) positions (1 ADG-V compatible). The rough order of magnitude cost for this alternative is estimated at $236 million, including hard and soft costs with a 10% construction contingency.

Option B is similar to Option A, but includes a rotunda connector with more spacious circulation around the concourse throat to enhance passenger level of service. Total gate count and RON positions are the same as Option A. The rough order of magnitude cost for this alternative is estimated at $345 million, including hard and soft costs with a 10% construction contingency.

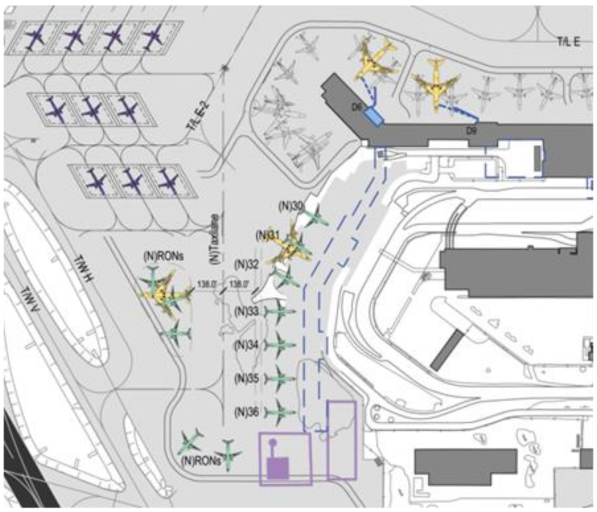
Option C includes a double-loaded concourse with rotunda connector to make more efficient use of concourse facilities. However, the three east deicing positions of the future 22L deicing pad prevented aircraft to park on the west side of the proposed concourse expansion due to required taxilane safety clearance areas. This eliminated a few potential ADG-III positions at the double-loaded concourse, providing for a net gain of just 8 ADG-III gates, 4 of which are ADG-V compatible. A total of 3 ADG-III RON positions can be accommodated south of the proposed airport traffic control tower. The rough order of magnitude cost for this alternative is estimated at $393 million, including hard and soft costs with a 10% construction contingency.

The evaluation matrix for the three North Terminal long-term concourse expansion options is shown on Figure 6-29. The following five criteria were assessed:

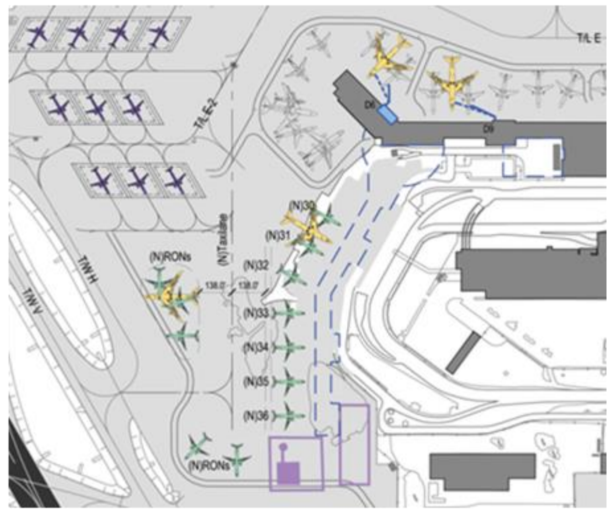
- Gates / remain overnight positions
- Rough Order of Magnitude (ROM) cost estimates
- Efficiency use of space (within the proposed concourse)
- Level of service – as defined by the International Air Transport Association
- Concession space

Figure 6-28
LONG-TERM NORTH TERMINAL CONCOURSE EXPANSION OPTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

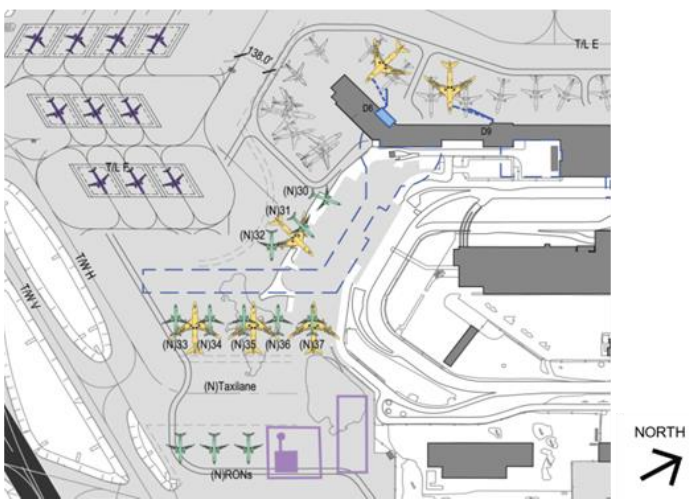
Option A: Single-loaded Concourse with Connector Bridge



Option B: Single-loaded Concourse with Rotunda



Option C: Double-loaded Concourse with Rotunda



Source: LeighFisher, November 2016.

Rough order of magnitude costs were based on 2016 dollars without escalation, and include both hard and soft costs with a 10% construction contingency. Use of space was calculated based on the metric of square feet per gate. The higher the metric, the less efficient the option is in terms of space utilization. Level of Service (LOS) is defined as a measurement of comfort experienced by passengers using the Airport terminal facility. The capacity of each element of a terminal facility can vary depending on the level of crowding and/or processing time that is considered acceptable. The terminal should be designed to maintain a minimum LOS, even during the peak periods of the day. LOS “C” corresponds to a situation of overall good levels of service, where flows are stable, delays are acceptable, and a good level of comfort is provided. Therefore, it is the industry accepted level of service standard. Designing to a LOS “A” standard could be overdesigning the facility to meet Thanksgiving Day demands; whereas, LOS “F” is defined as an unacceptable level of comfort.

Concession space is typically evaluated based on square feet per 1,000 enplaned passengers. The North Terminal is configured as a unit terminal which is synonymous to a medium hub operation in terms of annual enplaned passengers that the terminal processes. According to the 2015 Airport Revenue News Fact Book of published concessions data, 12.2 square feet per 1,000 enplaned passengers is the average metric for medium hub airports. If the square feet per passenger metric is too high, concessions may be oversized and individual store yields will be low.

Figure 6-29
EVALUATION OF LONG-TERM CONCOURSE EXPANSION OPTIONS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Gates/RONs	ROM Cost	Efficiency of Space	Level of Service	Concession Space
Option A 	**+7 ADG-III gates** *(1 ADG-V)* **+5 ADG-III RONs** *(1 ADG-V)*	**$236 M**	90,000 sf / 7 gates **13,000 sf / gate**	12,500 sf bridge/500 pax **25 sf/pax** *(LOS C = 24.7sf)*	**11.9 sf** per 1,000 EPAX in 2035 *(Average medium hub metric = 12.2 sf/1,000 EPAX)*
Option B 	**+7 ADG-III gates** *(1 ADG-V)* **+5 ADG-III RONs** *(1 ADG-V)*	**$345 M**	145,000 sf / 7 gates **20,700 sf / gate**	29,000 sf rotunda/500 pax **58 sf/pax** *(LOS C = 24.7sf)*	**17.7 sf** per 1,000 EPAX in 2035 *(Average medium hub metric = 12.2 sf/1,000 EPAX)*
Option C 	**+8 ADG-III gates** *(4 ADG-V)* **+3 ADG-III RONs** *(0 ADG-V)*	**$393 M**	174,000 sf / 8 gates **21,750 sf / gate**	29,000 sf rotunda/870 pax **33 sf/pax** *(LOS C = 24.7sf)*	**19.0 sf** per 1,000 EPAX in 2035 *(Average medium hub metric = 12.2 sf/1,000 EPAX)*

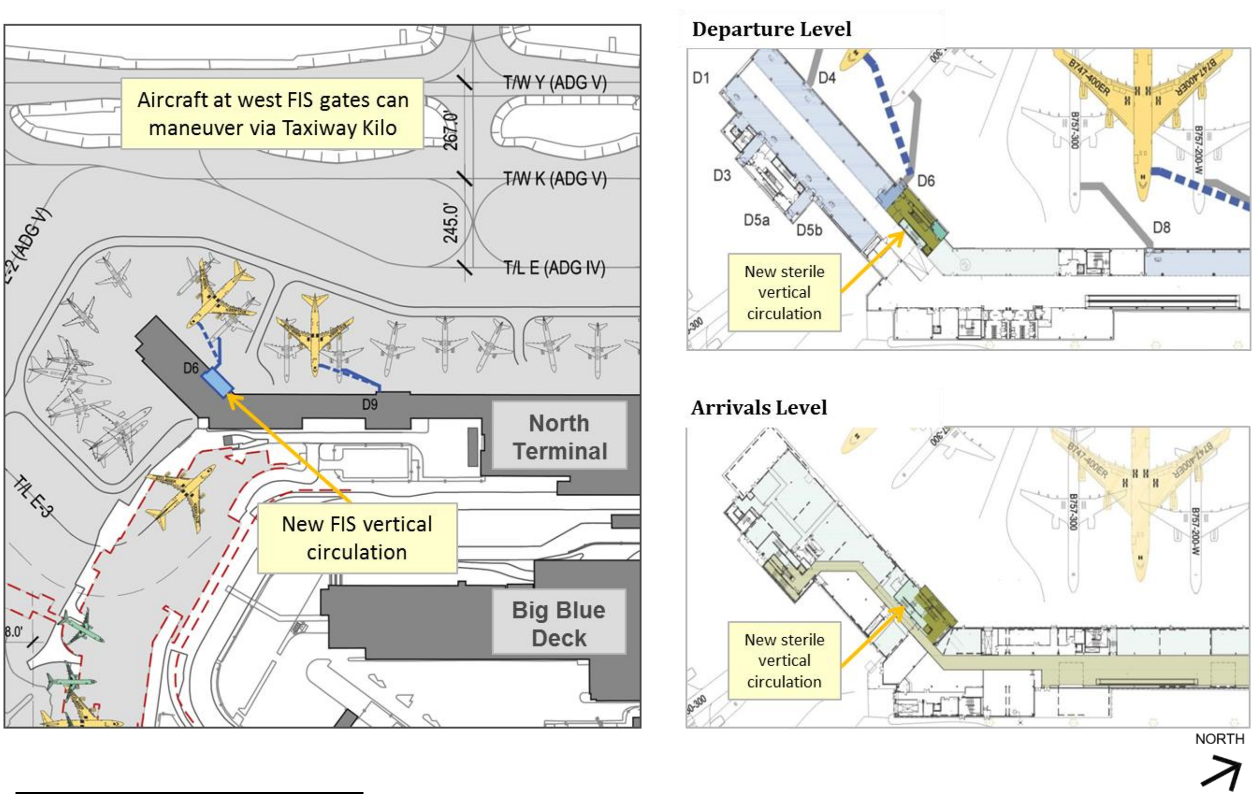
Source: LeighFisher, November 2016.

6.4.2.3 Widebody Gates with FIS Access

Currently, four of the North Terminal gates (D3, D5, D9, and D10) are FIS compatible with a sterile corridor connecting the jet bridges to the CBP checkpoint on the lower level of the Terminal. Authority staff indicated that there are already plans to add one ADG-V FIS gate east of D5 (to be called D7) due to increasing international demands. In a number of terminal subcommittee meetings, many discussions relating to how international growth should be handled were also considered. To address these concerns, the potential to add widebody gates with FIS access on the west gates between Gates D4 and D10 were examined.

As indicated on Figure 6-30, two widebody positions at Gates D6 and D9 can be accommodated on the west side with a two-for-one dependency, which means when a widebody aircraft is using the gate, it will eliminate two narrowbody aircraft from accessing the same gate. From an airfield perspective, it was vetted among the North Terminal subcommittee group that the widebody aircraft can maneuver in and out via Taxiway Kilo. From a facility perspective, a new FIS vertical circulation core will be required at Gate D6 that connects to the existing sterile corridor on the lower level of the CBP inspection area. New striping for the widebody position and a new passenger boarding bridge that is long enough to dock to the new widebody position are also required at both Gates D6 and D9. The order of magnitude cost for this alternative is estimated at $11 million, including hard and soft costs with a 10% construction contingency.

Figure 6-30
NORTH TERMINAL FIS GATE EXPANSION OPTION
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: LeighFisher, November 2016.

Chapter 7
FACILITIES IMPLEMENTATION PLAN

This chapter summarizes the implementation plan formulated to incrementally meet the requirements associated with the aviation demand forecasts, while taking into consideration capital projects to be constructed within the next five years. Provided herein is (1) the Authority's current Capital Improvement Program (CIP), (2) a summary of projects identified in the Master Plan, identified as near-, mid-, and long-term, including cost estimates, (3) the overall Recommended Development Plan (RDP), identifying a comprehensive list of projects recommended within the 20-year planning horizon.

Development of the RDP involved an extensive stakeholder engagement process, which included Authority staff, airline tenants, community leaders, and the general public. Recommended projects in each phase were determined by many factors including timing of safety enhancements, capacity constraints, financial feasibility, availability of funding sources, and alignment with the Authority's approved CIP.

This chapter is organized as follows:

- Existing Capital Improvement Program
- Recommended Development Plan and Phasing
- Environmental Overview and Strategy

7.1 EXISTING CAPITAL IMPROVEMENT PROGRAM

The Authority's existing CIP for the years 2017 through 2021 was approved by the board in September 2016. The CIP totals $804 million and is expected to be funded through a combination of General Airport Revenue Bonds, Passenger Facility Charges, grants, and discretionary Airport funds. These projects are all anticipated to be completed by 2021 with exception of the Phase 4 of the Big Blue Parking Deck Rehabilitation, which is expected to continue into 2022.

Projects included in the CIP are shown in Table 7-1, including cost estimates developed by the Authority.

Table 7-1
EXISTING CAPITAL IMPROVEMENT PROGRAM
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Project	Capital Improvement	Cost (millions)
	Airfield	
1	Runway 3L/21R & Associated Taxiways Reconstruction and 21R Deicing Pad Reconstruction	$180.0
2	Runway 3L/21R Enhancements Planning	0.7
3	Taxiway H Extension/Reconstruction and 22L Deicing Pad Expansion	18.0
4	Taxiway Z – Reconstruction & Relocation of Southern Portion Including Extension of Taxiway Service Road	16.0
5	Taxiway M3, M4 and Western Portion of Taxiway P4 Removal	0.9
6	Taxiway Kilo Reconstruction Program	54.0
7	Runway 21R Deicing Pad Reconstruction (Design only)	0.5
8	Airfield Pavement Rehabilitation and Reconstruction Plan	42.6
9	McNamara Apron Rehabilitation/Joint Repairs	86.6
10	Hangar 516 & 518 Apron Reconstruction	10.5
11	McNamara Apron Modifications and New Hardstand Positions	25.0
12	Taxilanes U-9 and Q Rehabilitation – Phase 1	30.0
	Subtotal Airfield	$464.8
	Cargo, Hangar & Commercial Development	
13	West Service Drive Improvements & Relocation	$ 7.9
	Power Plants & Electrical Distribution System	
14	East Service Drive Utilities Upgrade & Expansion	$ 7.3
15	Utility Command Center & Remote Metering	6.0
16	Medium Voltage Transmission Lines for Primary Service to the North Campus and Airfield	7.2
17	Primary Electrical Cable & Switchgear Replacement	0.5
18	North Power Plant Electrical Gear & Load Centers Replacement	2.5
19	Electrical Substations Replacement	4.0
20	North Power Plant Chillers & Support Systems	6.6
21	North Power Plant HVAC / Air Handler and Miscellaneous Improvements	2.8
22	South Power Plant Site Generators	10.0
23	Primary Electrical Loops Nos. 1-3 Upgrade & Expansion	5.1
24	North Power Plant Building Rehabilitation	3.0
25	McNamara Terminal HVAC Re-commissioning Study	0.6
	Subtotal Power Plants & Electrical Distribution System	$ 55.6
	Fleet & Equipment -	
26	Fleet & Heavy Equipment Acquisitions	$ 39.3
27	Compressed Natural Gas Fueling Facility	2.5
	Subtotal Fleet & Equipment	$ 41.8
	Parking & Ground Transportation Facilities	
28	Big Blue Parking Deck Rehabilitation – Phase 3	$ 4.1
29	Big Blue Parking Deck Rehabilitation – Phase 4	13.2
30	McNamara Parking Deck Rehabilitation	7.7
31	McNamara Terminal Deck Rehabilitation – Phase 2	6.6
32	Eureka Express Lot	8.1
33	Surface Lots LED Lighting Installation	1.6
34	North Terminal GTC Third Elevator and Escalator	0.5
35	Parking Lot Rehabilitation	6.7
36	Parking System Replacement	10.0
	Subtotal Parking & Ground Transportation Facilities	$ 58.5

Table 7-1 *(continued)*
EXISTING CAPITAL IMPROVEMENT PROGRAM
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Project	Capital Improvement	Cost (millions)
	Bridges & Roadways	
37	Dingell Drive Retaining Wall Reconstruction	$ 4.3
38	Bridges & Roadways Rehabilitation Program	24.9
39	Rogell Drive-Dingell Drive Connector	5.0
40	Rogell and Burton Drive Intersection Reconfiguration	7.0
41	Roadway LED Lighting Installation	1.2
42	Lucas Drive Enhancements	1.9
	Subtotal Bridges & Roadways	$ 44.3
	Security & Communications	
43	McNamara Terminal CBP CCTV	$ 0.9
44	Vehicle Checkpoint Enhancements – Sally Ports	0.6
45	Perimeter Fencing Cable Reinforcement	5.2
46	Checkpoint #1 Vehicle and Truck Screening Building	2.5
47	Security System & Network Upgrades – Phases 2 through 5	21.9
	Subtotal Security & Communications	$ 31.1
	Support Facilities	
48	Airport Authority Headquarters Building	$ 24.9
49	Roof Replacement Plan	3.1
50	Building 348 (Executive Terminal) Partial Restoration	0.3
51	Fire Training Facility Restoration and Burn Pit Replacement	5.5
52	ARFF Station 100 Improvements	1.2
53	Equipment Maintenance & Storage Facilities Replacement & Consolidation (Planning Only)	0.4
	Subtotal Support Facilities	$ 35.4
	Site Redevelopment & Demolitions	
54	Building 715 (Former NWA/DL Hangar) Demolition	$ 1.5
55	Buildings 714, 714A & 714B (Former Metro Flight Buildings) Site Redevelopment & Demolition	1.6
56	Building 534 (Former Flight Kitchen) Demolition	1.3
57	Building 358 (Former Police Station) Demolition	3.0
58	LC Smith & Berry Terminals Demolition	17.9
59	Rental Car Facilities Study	2.3
	Subtotal Site Redevelopment & Demolitions	$ 27.6
	Terminals	
60	North Terminal Gate Expansion	$ 20.8
61	North Terminal Interior Wall Panel Replacements	1.0
	Subtotal Terminals	$ 21.8
	Water Mains & Storm Water System	
62	Water Main Replacement	$ 4.0
63	Primary Pump & Switchgear Replacements	1.1
64	Storm and Sanitary Sewer Systems Replacements	2.5
	Subtotal Water Mains & Storm Water System	$ 7.6
	Other Projects	
65	Master Plan Update	$ 6.2
	Capital Improvement Plan Total	**$803.8**

Source: Cost estimates were provided by the Authority and released publically in the 2017 WCAA Budget Book.

7.2 RECOMMENDED DEVELOPMENT PLAN AND PHASING

This section describes the RDP for the Airport through 2035. Three time period were identified to represent future levels of activity at which improvements would be necessary.

- **Near-term**– corresponding to the 2016 through 2020 timeframe.
- **Mid-term**– corresponding to the 2021 through 2030 timeframe.
- **Long-term**– corresponding to the 2031 through 2035 timeframe.

The RDP incorporates the recommended airfield, ground transportation, and support facility projects identified in Chapter 6.

The RDP is assumed to be incremental to the CIP projects, and identifies additional projects to be implemented within the 20-year planning horizon. During development of the RDP, updated project costs were obtained, and additional analysis completed for a number of projects already included in the CIP. When updated costs were estimated to be higher than the existing CIP developed by the Authority, the incremental cost was included in the RDP. These projects are identified by footnotes in the table below.

Projects identified in the RDP are shown in Table 7-2, including rough order of magnitude cost estimates. Appendix G includes the independent cost estimates for each project.

Table 7-2

RECOMMENDED DEVELOPMENT PLAN COST ESTIMATES

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

Project	Improvement	Cost (in millions)
Near-term (2016-2020)		
1	Revised *incremental cost* of Runway 3L-21R reconstruction projects *(a)*	47.9
2	Closed taxiway pavement removal and service road construction	12.3
3	Taxiway F geometry	9.2
4	RON and apron upgrade upon demolition of Berry Terminal	19.0
5	McNamara island infill *(b)*	15.3
6	Taxiway Z relocation	14.0
7	Revised *incremental cost* Rogell-Dingell Connector *(c)*	1.2
8	Parking exit reconfiguration	0.4
9	Future development	3.3
10	Maintenance facility satellite location	7.2
11	Taxiway PP RON	10.4
	Subtotal	140.2
Mid-term (2021-2030)		
1	RON and apron pavements upon demolition of Smith Terminal	16.0
2	Runway 22L deicing pad reconfiguration	60.6
3	ROFA – 9R, 21L and 27R	1.5
4	Taxiway H bridge	16.2
5	Taxiway K geometry	7.4
6	Taxiway U bridge	18.9
7	Taxiway V2 removal	0.9
8	Taxiway W2 geometry	8.8
9	Taxiway Y3 demolition	1.0
10	Big Blue Parking Deck expansion	65.0
11	Revised *incremental cost* of Eureka Express Lot *(d)*	4.6
12	North Terminal exit roadway reconfiguration	5.1
13	Maintenance facility reconstruction	116.4
14	Non-perishable goods storage facility	10.0
	Subtotal	332.3
Long-term (2031-2035)		
1	Taxiway Y5 geometry	2.7
2	Taxiway K7 geometry	3.8
3	Taxiway W geometry	3.6
	Subtotal	10.1
	Recommended Development Plan Total	**482.8**

(a) The cost for the Runway 3L-21R reconstruction project in the Authority's CIP was $180 million including $11.5 million for design. The revised cost estimate for the project per the Master Plan is $228 million.

(b) The $15.3 million McNamara island infill project is separate from the $86 million McNamara Apron Rehabilitation/Joint Repairs project included in the Authority's CIP.

(c) The cost for the Rogell Drive-Dingell Drive Connector project in the Authority's CIP was $5.0 million. The revised cost estimate for the project per the Master Plan is $6.2 million.

(d) The cost for the Eureka Express Lot in the Authority's CIP was $8.1 million. The revised cost estimate for the project per the Master Plan is $12.7 million.

Sources: LeighFisher, HNTB, and Connico, Inc., March 2017.

7.2.1 Near-Term (2016-2020) Projects

In the near-term, primary recommendations are the reconstruction of both Runway 3L-21R and the 21R deicing pad and its associated taxiway connectors. Some projects included in the near-term are from Wayne County Airport Authority's existing Capital Improvement Plan, and not part of the master plan recommendations. Projects included in the near-term implementation plan are shown on Figure 7-1. The numbering of projects described in the text corresponds to the project numbers represented in the figure.

1. Runway 3L-21R and associated taxiway and 21R deicing pad reconstruction

The Runway 3L-21R pavement has reached the end of its useful life and needs to be reconstructed. The runway width is currently 200 feet, which exceeds the FAA standard of 150 feet, and a width greater than 150 feet is not needed to support the existing and future forecast fleet mix. Runway 3L-21R does not currently have paved shoulders and a proposed reconstruction will provide 35-foot paved runway shoulders. After extensive evaluation in the Master Plan Update, the runway will be reconstructed along its existing centerline. The project includes enhancements to connector taxiways as well as an extension of Taxiway P to Taxiway F. This extension will minimize taxi time for aircraft that would normally taxi to the end of Runway 21R by way of Taxiway PP, Taxiway F, Taxiway W, and Taxiway P. Additional connector taxiways near the runway ends will allow for greater aircraft sequencing capabilities. The project includes a reconfiguration of the Runway 21R deicing pad which will it allow the pads to be reconfigured to clear present day departure obstacles and allow for the deicing pads be brought up to new design standards.

2. Closed taxiway pavement removal and service road construction

An emphasis of the FAA is to remove pavement that is out of date and no longer in use. This project will remove the closed taxiway pavement north of Runway 3L-21R which could otherwise cause confusion for pilots. This project will also include the construction/reconstruction of service roads near Runway 21R to allow Airport vehicles to maneuver around the runway without needing to travel on the runway/taxiway system.

3. Taxiway F geometry

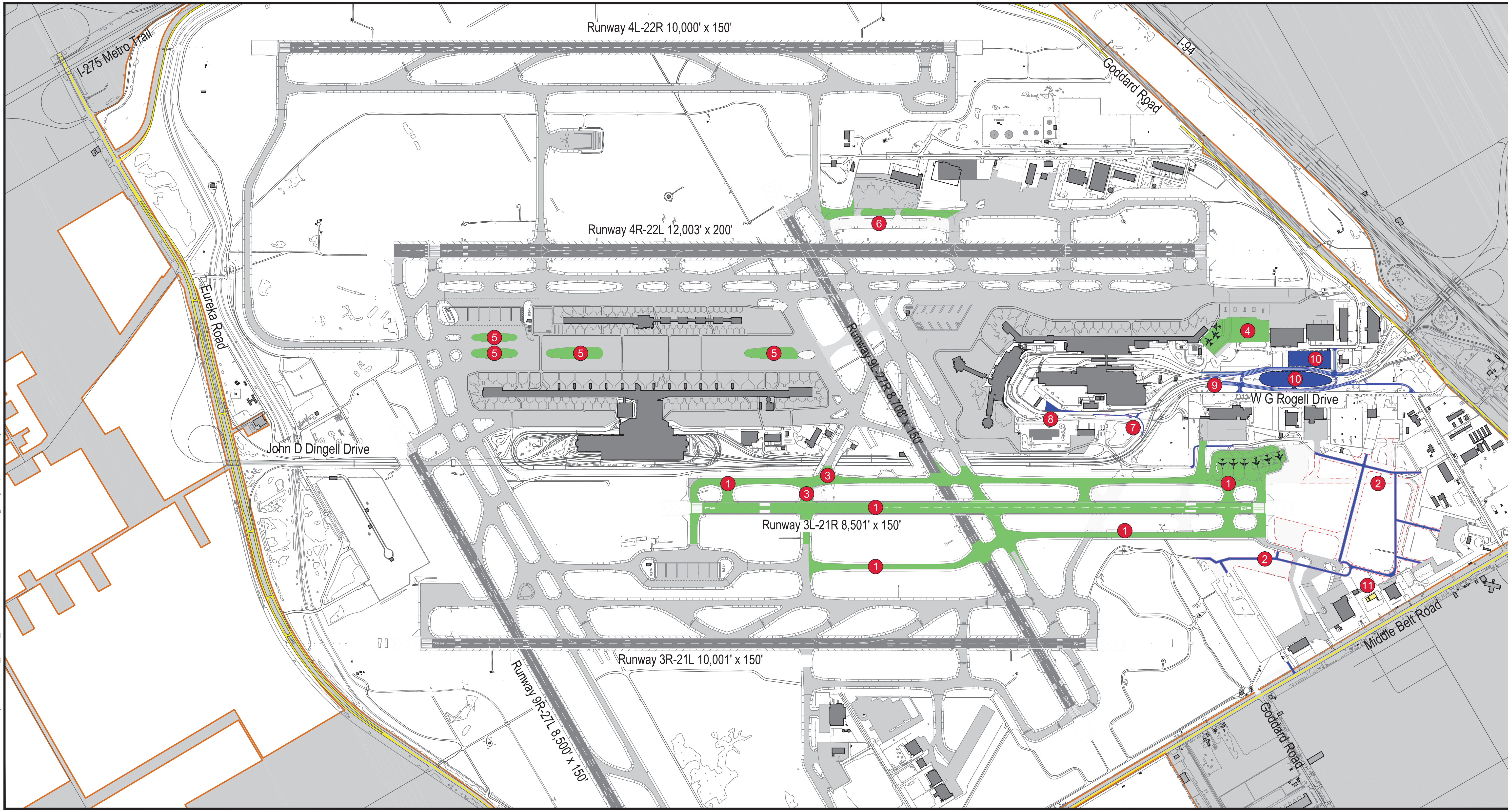
Taxiway F currently intersects Runway 3L-21R at an angle other than a right angle. Chapter 4 of AC 150/5300-13A, Change 1, recommends that runway crossings be limited to 90 degree crossings to improve pilot visibility of the runway environment and to improve situational awareness. The proposed project will reconfigure the taxiway to intersect the runway at a 90-degree angle to comply with FAA advisory criteria.

4. RON and apron upgrade upon demolition of Berry Terminal

An emphasis of the Master Plan has been to provide an adequate number of parking positions for RON aircraft. The demolition of the vacant Berry Terminal provides an opportunity to reconfigure RON layouts north of the North Terminal for RON aircraft parking.

5. McNamara island infill

There are four islands near the McNamara Terminal between the A and B/C concourses that are open areas. This can reduce the flexibility of aircraft movements on the apron in an area that requires significant flexibility due to aircraft tug/tow and push back operations. The project to fill these islands will facilitate better aircraft movement in this area.



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LEGEND

- Airport property line
- Pavement to be removed
- Airfield projects
- Aviation support projects
- Ground transportation projects

NEAR-TERM PROJECTS:

1. Runway 3L-21R and associated taxiway and 21R deicing pad reconstruction
2. Closed taxiway pavement removal and service road construction
3. Taxiway F geometry
4. RON and apron upgrade upon demolition of Berry Terminal
5. McNamara island infill
6. Taxiway Z relocation
7. Rogell-Dingell connector
8. Parking exit reconfiguration
9. Rogell and Burton Drive intersection reconfiguration
10. Future development
11. Maintenance facility satellite location

Note: Some projects included in the near-term phase are from Wayne County Airport Authority's existing Capital Improvement Plan

NORTH

0 700' 1400' 2800'

Figure 7-1
MASTER PLAN PROJECT IMPLEMENTATION
NEAR-TERM (2016-2020)
Facilities Implementation Plan
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

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6. Taxiway Z relocation

The standard runway to taxiway offset for Runway 4R-22L is 500 feet. Currently, Taxiway Z north of Taxiway V and south of Taxiway Connector Z5 is located 400 feet from Runway 4R-22L centerline. This project will address the existing nonstandard condition and relocate the taxiway to meet standards.

7. Rogell-Dingell Connector

Currently drivers exiting the North Terminal heading south toward the McNamara Terminal or Eureka Road must proceed northbound on W. G. Rogell Drive and make a U-turn at the Burton Drive signalized intersection to reach southbound John D. Dingell Drive. This project will add a new flyover ramp from W. G. Rogell Drive as it exits the North Terminal to southbound John D. Dingell Drive. The ramp will begin near the Big Blue Parking Deck on the east side of the roadway, crossing over E Service Drive and providing a direct connection for traffic leaving North Terminal destined for either the McNamara Terminal or the south Airport exit. As vehicles using the ramp will no longer need to make a U-turn at the W. G. Rogell Drive and Burton Drive intersection, vehicle volumes at the intersection will be reduced improving overall operations.

8. Parking exit reconfiguration

The configuration of the existing exit from the Big Blue Parking Deck to W. G. Rogell Drive provides a short area to merge with traffic exiting the North Terminal. This project will reconfigure the Big Blue Parking Deck exit roadway to increase the length of acceleration lane and provide a shallower merging angle between the parking exit lane and W. G. Rogell Drive.

9. Rogell and Burton Drive intersection reconfiguration

Congestion currently occurs along W. G. Rogell Drive approaching the North Terminal from I-94 and at the intersection of W. G. Rogell Drive and Burton Drive with intersection operations frequently causing backups onto the service roads. This project will remove the existing traffic signal at the intersection of W. G. Rogell Drive and Burton Drive and realign Burton Drive to provide a larger median between the northbound and southbound lanes. Access from the west and east service drives to W. G. Rogell Drive will be split with access moving north and south along Rogell Drive, respectively. Each intersection will be served by a new two-phase traffic signal compared to the existing three-phase signal, thereby increasing roadway capacity along W. G. Rogell Drive.

10. Future development

The reconfiguration of W. G. Rogell Drive provides additional median space between the northbound and southbound lanes. This area is proposed for future development and could be used for a cell phone lot and / or commercial development. The land to the north of W. G. Rogell Drive would also be available for non-aeronautical uses such as commercial development or a relocated commercial vehicle hold lot when the existing hold lot is needed for other development.

11. Maintenance facility satellite location

The need for a secondary breakroom facility for the field maintenance crews drove the location of the Maintenance facility satellite building to the east side of the Airport. This facility will increase operational efficiencies during snow removal and emergency operations as well as daily operations such as mowing and field maintenance. Maintenance crews will now be able to take breaks, use restrooms, and have meals in the new satellite facility without having to return to the existing Maintenance Facility located on the far north end of the Airport.

7.2.2 Mid-Term (2021-2030) Projects

In the mid-term, primary recommendations are the projects around the North Terminal, such as RON and apron pavements upon demolition of Smith Terminal, the Runway 22L deicing pad reconfiguration, Big Blue Parking Deck expansion, and the South remote parking lot. Projects included in the mid-term implementation plan are shown on Figure 7-2. The numbering of projects described in the text corresponds to the project numbers represented in the figure.

1. RON and apron pavements upon demolition of Smith Terminal

As mentioned previously, the development of the alternatives focused on providing additional parking for RON aircraft. The demolition of the Smith Terminal provides another opportunity to not only allow for more positions, but to provide access to and parking for larger aircraft such as a B747-400 and eventually aircraft such as the A350-1000.

2. Runway 22L deicing pad reconfiguration

The Runway 22L deicing pad currently services small and medium size regional jets. Industry trends continue to suggest that these aircraft with less seats will continue to be phased out making way for larger regional jet aircraft that are more in-line with the size of today's narrowbody aircraft. This proposed change in fleet mix is the driver behind the reconfiguration which will also bring the pad up to current FAA design standards. The 22L deicing pad will continue to provide the capability to deice 10 aircraft simultaneously. In addition, the pad incorporates a single widebody capable deicing position for the North Terminal carriers.

3. ROFA – 9R, 21L and 27R

The Runway Object Free Area (ROFA) is an airport design surface that is meant to be kept clear of all above ground objects that are not a requirement for air navigation. These projects will address impeding Airport service roads in three different areas. Once completed, Airport vehicles will be able to traverse these areas will little or no impact to airport operations.

4. Taxiway H bridge

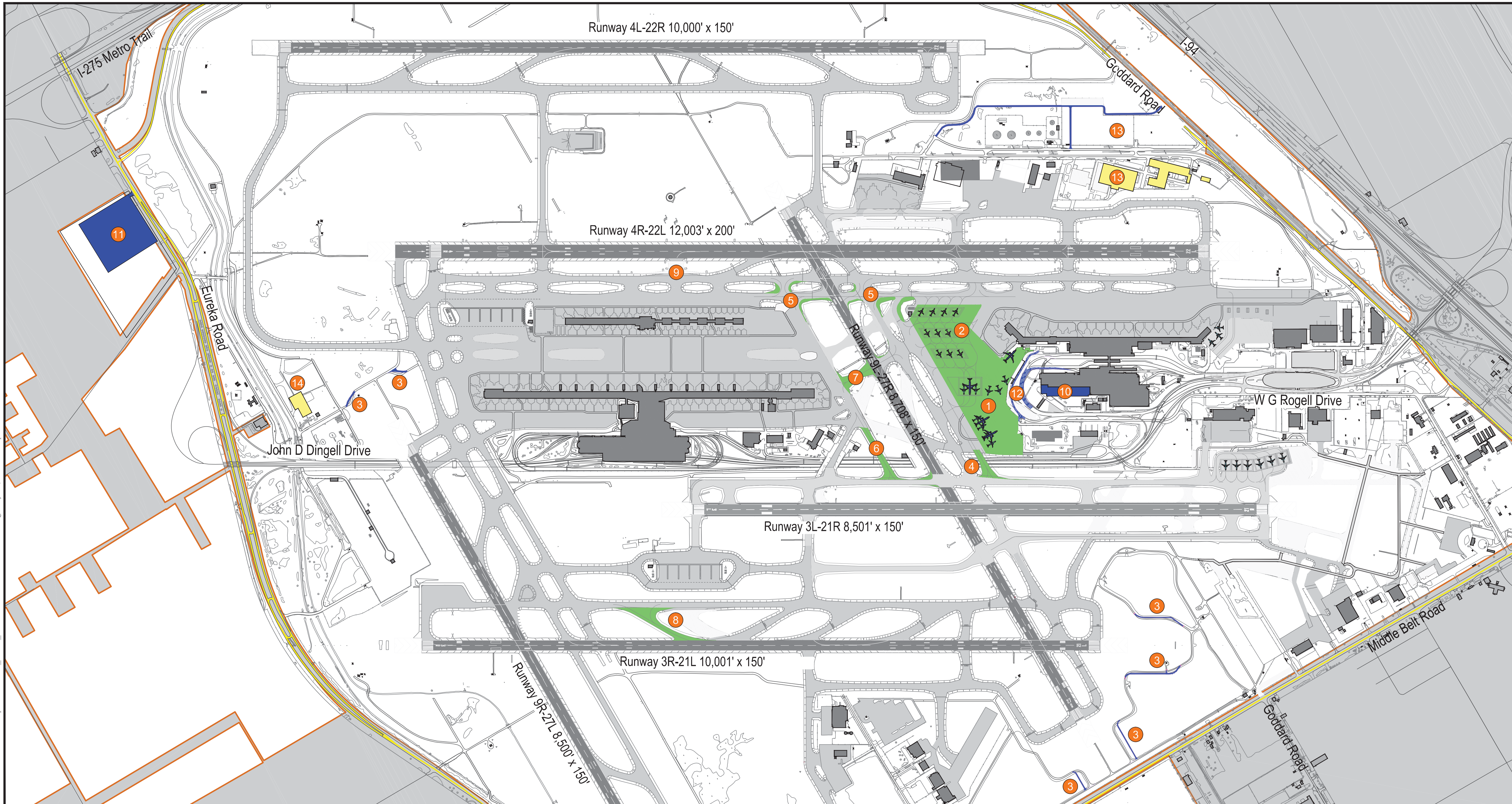
Future development of the Smith Terminal area will increase aircraft movements in the vicinity of both Taxiway V and Taxiway H. The extension of Taxiway H over John D. Dingell Drive will allow for increased flexibility in routing aircraft to and from the new development area.

5. Taxiway K geometry

The current offset between Taxiway Y and Taxiway K is 227 feet between Taxiway U and Taxiway K6. This limitation is caused by the Runway 22L deicing pad. The future Runway 22L deicing pad configuration will make it possible for the Taxiway K centerline to be shifted east and meet the standard offset requirement of 267 feet. This will greatly improve ATC movement of ADG V aircraft in this area.

6. Taxiway U bridge

The Taxiway H bridge is anticipated that aircraft movement in between the terminals will increase as future development progresses. The Taxiway U extension across John D. Dingell Drive allows for a Runway 9L-27R parallel taxiway connection to Taxiway M. This project will all but eliminate the need to taxi on Runway 9L-27R, which is something that is discouraged by the FAA.



LEGEND

- Airport property line
- Airfield projects
- Aviation support projects
- Ground transportation projects

MID-TERM PROJECTS:

1. RON and apron pavements upon demolition of Smith Terminal
2. Runway 22L deicing pad reconfiguration
3. ROFA - 9R, 21L and 27R
4. Taxiway H bridge
5. Taxiway K geometry
6. Taxiway U bridge
7. Taxiway G and V2 geometries
8. Taxiway W2 relocation
9. Taxiway Y3 demolition
10. Big Blue Parking Deck expansion
11. South remote parking
12. North Terminal exit roadway reconfiguration
13. Maintenance facility reconstruction
14. Non-perishable goods storage facility

NORTH

0 700' 1400' 2800'

Figure 7-2
MASTER PLAN PROJECT IMPLEMENTATION
MID-TERM (2021-2030)
Facilities Implementation Plan
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

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7. Taxiway G and V2 geometries

Another emphasis of the FAA RIM program is to eliminate complex taxiways which include acute angle runway connector taxiways, y-shaped runway crossings, and convergence of numerous taxiways entering a runway. The proposed project shown here will remove the complex geometry and replace the connector taxiway with one that intersects the runway at a 90-degree angle.

8. Taxiway W2 relocation

Taxiway W2 is also a RIM condition where there is a convergence of taxiways entering a runway. The proposed project will relocate Taxiway W2 so that it intersects Runway 3R-21L at a location different than that of Taxiway W3.

9. Taxiway Y3 demolition

Taxiway Y3 provides direct taxiing access to runways from the apron area. This is also a geometry code included in the RIM program. Mitigation for these instances can include removing connector taxiways, constructing parallel taxiways, constructing no-taxi islands, relocating taxiway connectors, installing elevated guard lights, installing runway status lights, or any combination of these. For Taxiway Y3, it was determined that the connector taxiway can be removed without impacting airfield capacity.

10. Big Blue Parking Deck expansion

Currently, the majority of on-Airport parking is provided in the two parking garages with 9,413 spaces in the McNamara Garage and 6,164 spaces in the Big Blue Parking Deck. The Big Blue Parking Deck is located closest to the North Terminal but due to its lower pricing some passengers park in this garage and take the inter-terminal shuttle to McNamara. In the mid-term, the Airport is projected to be deficient by approximately 1,500 public spaces growing to 5,000 in the long-term. To accommodate demand in the mid- and long-terms, this project provides 2,000 additional parking spaces in the Big Blue Parking Deck. This expansion would only require minimal reconfiguration of the parking exit plaza to accommodate the larger footprint.

11. South remote parking

Currently all remote public parking is on the north side of the Airport. This project would develop a new remote surface parking on the south side of the Airport property along Eureka Drive. The site selected for this facility is approximately 14.7 acres in size and will accommodate approximately 2,000 public parking spaces, but could expanded to 5,000 in the future. This parking lot will provide options for passengers to on the south side, closer to the McNamara Terminal.

12. North Terminal exit roadway reconfiguration

The demolition of the Smith Terminal will require removal of the elevated roadway structure that currently serves the terminal. The demolition provides an opportunity to reconstruct the outbound North Terminal roadway and widen the connection from the North Terminal Ground Transportation Center and lower level roadway, lengthening the merge distance. This project will reconstruct W. G. Rogell Drive south of the Big Blue Parking Deck, providing a smoother curve and eliminating the multiple connections from the Smith Terminal. The service road connecting East Service Drive and the North Terminal will also be reconstructed ensuring access after the Smith Terminal and elevated roadways are demolished.

13. Maintenance facility reconstruction

The Maintenance facility program developed from staff interviews, identified that some of the maintenance operations needed to be expanded or replaced. To accomplish the updated program, new operational adjacencies and additional facilities were required. Preserving the existing Airport Maintenance Facility building 703, a renovation and expansion plan was developed to incorporate Fleet Services Maintenance, Inventory Logistics, trade shops, conference rooms, breakrooms, offices, locker room, training rooms, exercise facility, and a new observation tower. A new 150,000 square feet Fleet Vehicle Storage building is also required to meet the program requirement which is located on the adjacent sites of existing buildings 704 and 705. Those structures and building 711 will be demolished to make space for the new Maintenance Facility and additional parking will be provided adjacent to the buildings, to meet the program requirements. A remote employee north parking lot is proposed for approximately 1,700 vehicles to the west of the Maintenance Facility.

14. Non-perishable goods storage facility

During the review and refinement process, Delta Air Lines requested relocation of their non-perishable goods storage facility closer to their outbound flights at the McNamara Terminal for more efficient operation. The proposed Sky Chef site from the previous master plan was reassessed as appropriate for implementation in the mid-term.

7.2.3 Long-Term (2031-2035) Projects

In the long-term, three taxiway geometry projects are recommended as shown on Figure 7-3. The numbering of projects described in the text corresponds to the project numbers represented in the figure.

1. Taxiway Y5 geometry

Taxiway Y5 provides direct taxiing access to runways from the apron area. As mentioned above, mitigation for these instances can include removing connector taxiways, constructing parallel taxiways, constructing no-taxi islands, relocating taxiway connectors, installing elevated guard lights, installing runway status lights, or any combination of these. For Taxiway Y5, it was determined that relocating the taxiway connector is necessary to make an aircraft turn onto the parallel taxiway before turning onto the connector taxiway. This additional maneuver will improve a pilot's situational awareness and prevent a runway incursion that is more susceptible by a straight alignment to the runway.

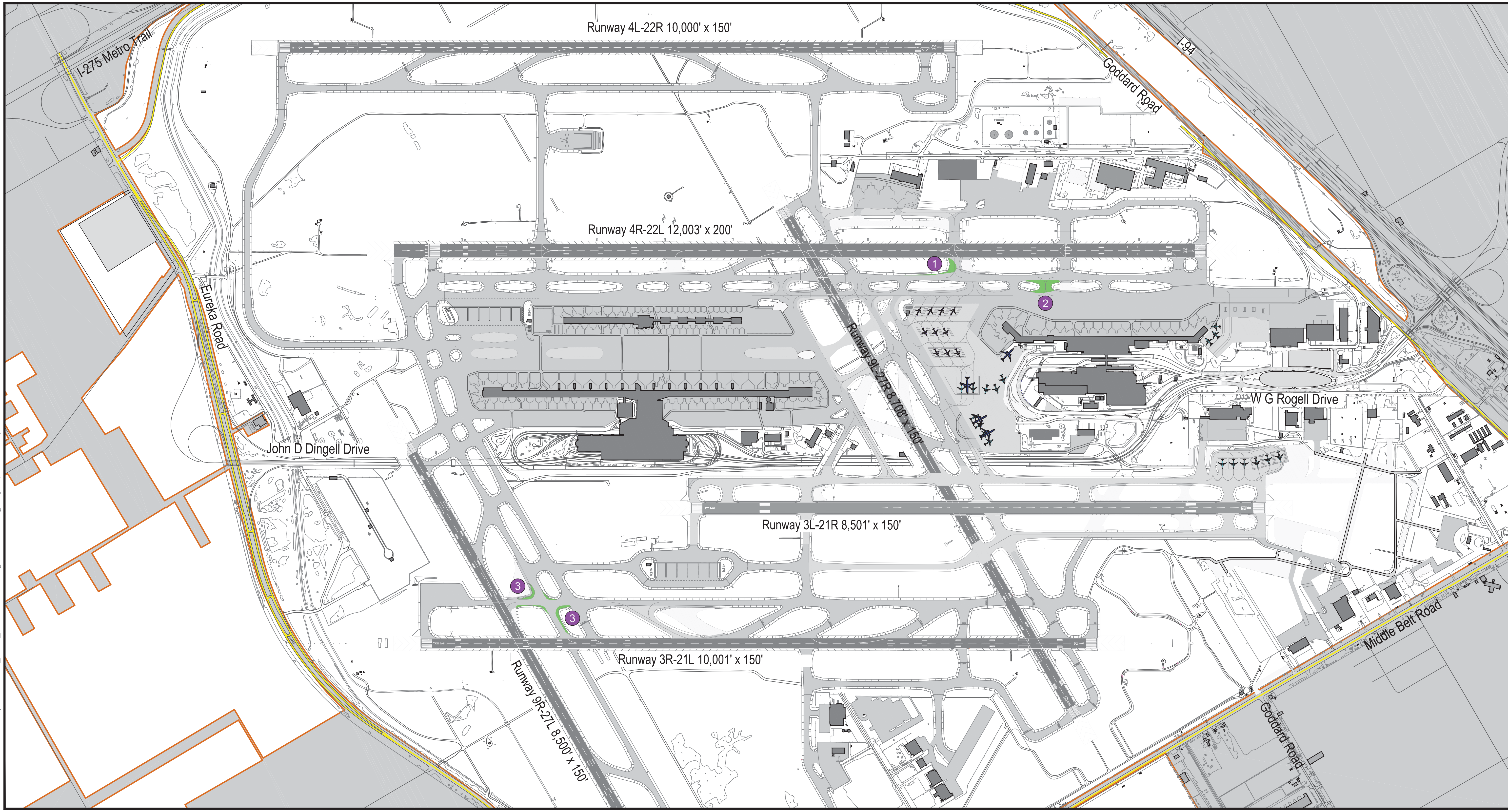
2. Taxiway K7 geometry

Similar to the above Taxiway Y5 geometry, it was also determined that a relocation of connector Taxiway K7 is necessary to eliminate the direct access to the runway from and apron area.

3. Taxiway W geometry

The release of AC 150/5300-13A in 2014 introduced new taxiway design standards, specifically taxiway fillet design. In most instances at airports that already accommodate large aircraft, the impacts are small. However, there are instances at the Airport such as the Taxiway W geometry where expanded fillets are necessary to allow for adequate taxiway edge safety margins for taxiing aircraft.

Figure 7-4 illustrates the combined recommended phasing projects for the near-term, mid-term, and long-term development, which makes up the Recommended Development Plan.



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LEGEND

Airport property line

Airfield projects

LONG-TERM PROJECTS:

1 Taxiway Y5 geometry

2 Taxiway K7 geometry

3 Taxiway W geometry

NORTH

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Figure 7-3

MASTER PLAN PROJECT IMPLEMENTATION

LONG-TERM (2031-2035)

Facilities Implementation Plan
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

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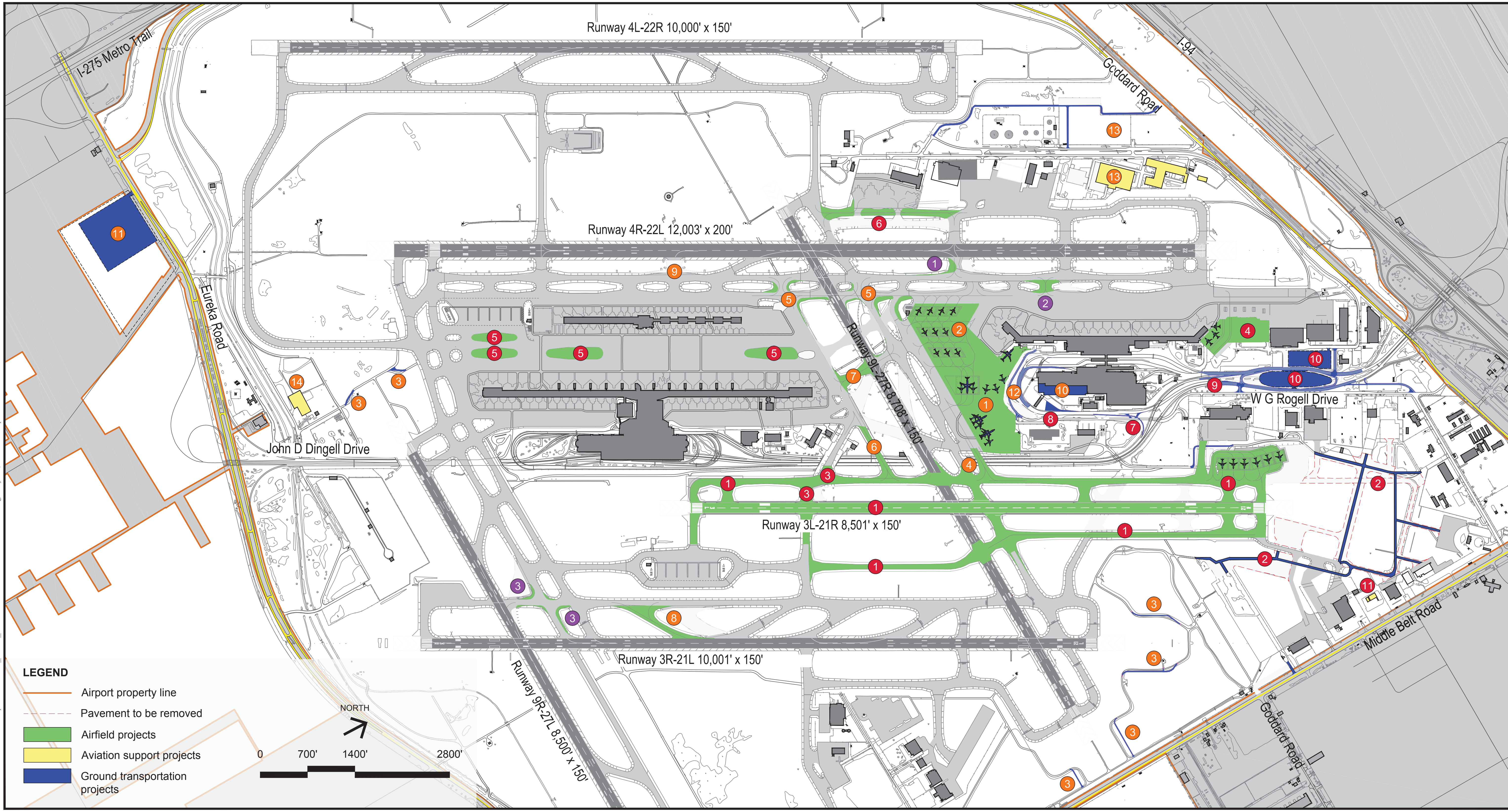

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NEAR-TERM PROJECTS (2016-2020):

1. Runway 3L-21R & associated taxiway and 21R deicing pad reconstruction
2. Closed taxiway pavement removal and service road construction
3. Taxiway F geometry
4. RON and apron upgrade upon demolition of Berry Terminal
5. McNamara island infill
6. Taxiway Z relocation
7. Rogell-Dingell connector
8. Parking exit reconfiguration
9. Rogell and Burton Drive intersection reconfiguration
10. Future development
11. Maintenance facility satellite location

Note: Some projects included in the near-term phase are from Wayne County Airport Authority's existing Capital Improvement Plan

MID-TERM PROJECTS (2021-2030):

1. RON and apron pavements upon demolition of Smith Terminal
2. Runway 22L deicing pad reconfiguration
3. ROFA - 9R, 21L and 27R
4. Taxiway H bridge
5. Taxiway K geometry
6. Taxiway U bridge
7. Taxiway G and V2 geometries
8. Taxiway W2 relocation
9. Taxiway Y3 demolition
10. Big Blue Parking Deck expansion
11. South remote parking
12. North Terminal exit roadway reconfiguration
13. Maintenance facility reconstruction
14. Non-perishable goods storage facility

LONG-TERM PROJECTS (2031-2035):

1. Taxiway Y5 geometry
2. Taxiway K7 geometry
3. Taxiway W geometry

Figure 7-4
MASTER PLAN PROJECT IMPLEMENTATION
RECOMMENDED DEVELOPMENT PLAN
Facilities Implementation Plan
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
July 2017

Leigh | Fisher

7.3 ENVIRONMENTAL OVERVIEW AND STRATEGY

The following sections identify probable environmental effects of the RDP and potential environmental approvals that would be needed to implement individual projects. The recommendations of the Master Plan in combination with the existing CIP are not expected to have significant impacts on the environment.

The environmental overview is not a replacement for the analysis associated with environmental review and compliance. Master plans contain an environmental overview to ensure that an airport sponsor considers potential environmental effects early in the planning process to: (1) enable avoidance of adverse effects, if possible, (2) enable mitigation measures to be identified to reduce effects, and (3) ensure that mitigation needs and costs are captured as sponsors move to implement the recommendations of the plan. Because the Authority has an existing CIP that will eventually reflect the RDP, the environmental overview includes consideration of current CIP projects.

A secondary benefit of the environmental overview is to identify the potential federal environmental processing/compliance requirements of proposed development. Environmental processing requirements for development projects can include:

- Compliance with the National Environmental Policy Act of 1969 (NEPA)
- Compliance with federal special purpose environmental laws (i.e., Clean Water Act or Clean Air Act) and any associated permitting

Each of these compliance requirements takes time and may require information that is not typically produced in a master plan, but rather occurs later in the project delivery process at the time the project is ripe for evaluation and defined sufficiently to enable that evaluation. Typically, a master plan identifies a project concepts which are later refined during the design and engineering process.

7.3.1 Resources that Could Be Affected

Table 7-3 identifies potential effects of the Master Plan RDP and the CIP projects and, if known, any permits and approvals that might also be needed.

7.3.2 NEPA Requirements

This section reviews the requirements of NEPA and discusses possible approaches to compliance with NEPA before implementation of projects included in the CIP and RDP.

Before the FAA can approve federal actions (such as the ALP, issue AIP funding, or enable PFC use), NEPA compliance would be required. In addition to compliance with NEPA, projects that affect the environment must also consider the requirements of the special purpose environmental laws. There are approximately 40 special purpose federal laws, executive orders, and regulations protecting particular parts of the environment, such as the Clean Air, Clean Water, Endangered Species, and National Preservation Acts, and an Executive Order on Protection of Wetlands.

NEPA requires all federal agencies to consider the effect on the environment before taking a federal action. The FAA has issued two Orders that address the requirements of NEPA:

- FAA Order 1050.1F *Environmental Impacts: Policies and Procedures*: This order addresses NEPA compliance for all Divisions of the FAA;
- FAA Order 5050.4B *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* which expands upon 1050.1 requirements for projects of the Airports Division of the FAA.

Table 7-3

SUMMARY OF PROBABLE ENVIRONMENTAL EFFECTS OF THE RECOMMENDED DEVELOPMENT PLAN

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

Environmental Category	Probable Effects
Air quality	Generation of emissions during construction and operation. Before FAA can approve federal actions, completion of conformity requirements would be needed because of the nonattainment and maintenance designations for SO_2, CO, and $PM_{2.5}$
Biological resources	No project-related effects.
Climate	Generation of emissions during construction and operation. However, in the context of global greenhouse gas emissions, airport emissions would not expected to be notable.
Coastal resources	No project-related effects.
Historical, architectural, archaeological, and cultural resources	Two buildings (Building 358 and 348) and parts of the airfield that would be altered by the CIP are known to have historical importance. Both buildings would be demolished. The Airports current CRMP notes that only Building 348 (Executive Terminal) is eligible for the National Register of Historic Places. Before the projects could be completed, FAA would need to complete Section 106 consultation and applicable 4(f) requirements.
DOT 4(f)	No parks exist on Airport, thus, the Dot 4(f) effects would be those noted above for historic, architectural, archaeological, and cultural resources. Before a project can be undertaken that affects DOT 4(f) resources, it must be shown that there are no other prudent and feasible alternatives and that all steps have been taken to minimize harm.
Farmlands	No project-related effects.
Hazardous materials, solid waste, and pollution prevention	A number of CIP and MP projects could occur on sites with known contamination. Before such projects are initiated a cleanup plan may be required. Implementation of the Airport's best management practices would minimize risk.
Land use	Project is expected to be consistent with planned land use and zoning.
Natural resources and energy supply	Energy and natural resources would be consumed during construction and in operation.
Noise and noise compatible land use	No project-related impacts identified.
Socioeconomic, environmental justice, and children's environmental health and safety risks	No project-related impacts identified.
Visual effects and light	Change in visual conditions associated new facilities. However, these effects are in keeping with an airport.
Water resources	Further development intensification of Airport lands would add impervious surface. No material water quality effects would be expected.

Source: Synergy Consultants, January 2017.

One of the major products of the master planning process is the Airport Layout Plan (ALP), which shows the Airport's existing facilities and planned development. Nearly all ALPs are conditionally approved by the FAA without a federal environmental document, as most projects are not ripe for NEPA documentation upon completion of a plan. The formal environmental evaluation process is undertaken at a later date to ensure that it is current within the time frame of the actual project development; before construction can commence, the condition must be removed through compliance with NEPA and any applicable special purpose laws.

Federal regulations identify three types of NEPA compliance documents:

- **Categorical Exclusion (CatEx)** – applies to a specific list of actions identified by FAA that have been found to produce no extraordinary circumstances (i.e., no significant environmental impacts or controversy). CatEx documentation, if required, can often be prepared in a matter of months.
- **Environmental Assessment (EA)** – applies to a small list of actions specifically identified by the FAA or that have been found by experience to have environmental impacts. The purpose of an EA is to determine whether the proposed project would have significant impacts. Upon review of the EA findings, the FAA either issues project approval in the form of a Finding of No Significant Impact (FONSI)* or directs the preparation of an Environmental Impact Statement (EIS) to further investigate potential environmental impact. The timeline associated with preparing an EA can range from a year to several years, depending on the complexity of the project and its effects.
- **Environmental Impact Statement (EIS)** – applies to a specific list of projects, such as a new runway, and those actions that have been found to have significant environmental impacts. On average an EIS requires 4 years to complete.

The FAA is the agency ultimately responsible for compliance with NEPA. However, FAA Orders allow the FAA to delegate the preparation of documentation to support a CatEx or an EA to the airport sponsor, such as the Authority. Only the FAA can prepare an EIS.

7.3.3 NEPA Considerations

This following summarizes issues and strategies related to obtaining NEPA compliance for the RDP and/or the existing CIP projects. The primary issues to be considered when developing the NEPA processing approach are the following:

- **Timing**: FAA guidance specifies that FAA NEPA approvals, once made, are good for 3 years as long as the project is substantially underway. FAA staff often suggest NEPA should not be initiated for projects unless the sponsor needs to begin construction in the next 5 to 7 years. Thus, careful consideration must be given to the timeline associated with the projects needed through 2025, as those projects are the ones that FAA would likely begin NEPA.
- **Federal Actions**: As NEPA is triggered by a federal action, one of the key steps that must be undertaken is identifying the federal action(s) that may be triggered. In many cases the federal action(s) is clear – before the project can be initiated, the FAA must **either** provide funding or approval the ALP. However, other federal actions exist that may also apply. Specific federal actions that might be applicable to current or future Airport projects can include:
    - Approval of federal funding for airport planning and development projects, including separate funding of plans and specifications for those projects.

*A FONSI can also be a Mitigated FONSI, were the EA has identified mitigation to address all significant impacts.

- Authorizing an airport sponsor to use Passenger Facility Charges (PFC).
- Approval of an airport sponsor's request under 49 USC, section 47125, to use or transfer Federally-owned land to carry out an action under 49 USC Chapter 471, Subchapter I, at a public-use airport or to support the airport's operations.
- Approval an airport sponsor to release airport land from a Federally-obligated, public-use airport when the land would be used for non-aeronautical purposes.

In the case of Master Plan Development Recommendations and the CIP, the project elements would require a change to the ALP and the Airport may seek federal funding (AIP or PFC funding) to implement the development. Therefore, there is a high likelihood that the development recommendations would require NEPA compliance before FAA unconditional approval could be granted.

- **Categorically Excluded**: Under NEPA, a Categorically Excluded project may require documentation. FAA Order 1050.1F Paragraph 3-1.2 identifies the projects normally requiring an EA, whereas Paragraph 3-1.3 identifies those that require an EIS. The list of Categorically Excluded projects is found in 1050.1F Paragraph 5-6, as long as the project does not create extraordinary circumstances, discussed in the next paragraph.

- **Probable Effects**: Projects that create an unmitigated significant impact would require an EIS. The FAA's guidance identifies the thresholds of significance and issues to be considered for each environmental category. Unless projects are specifically identified as requiring an EA or EIS, the effects of the project drive the environmental documentation. Therefore, it is important to understand the probable effect before proceeding into one form of documentation over another. Early identification of key environmental resources in the airport area that may be affected by a project or action can be very useful in assisting with understanding the environmental processing strategy. For example, projects usually cannot be categorically excluded if the project:

  - Requires an individual wetland fill permit;
  - Is likely to generate controversy as defined by FAA Orders;
  - Would convert land protected under the Farmland Protection Act;
  - Generate significant project-related adverse aircraft noise exposure;
  - Involve acquisition of land greater than 3 acres in size; or
  - Triggers a special purpose law, including: violation of the Clean Air Act; affects resources protected under the Coastal Management Act, impact on a DOT 4(f) land, etc.

  Further, if a project creates a significant effect that cannot be mitigated, then an EIS must be undertaken.

- **Project Connections:** Another essential step in identifying the environmental processing strategy is ensuring that all facets of the project are identified. This includes identifying all projects and actions that are needed to enable or support the primary action. Because of this connection, NEPA and the President's Council on Environmental Quality regulations require these actions to be considered in a single NEPA document. Over the years, the terms "enabling actions" and "connected actions" have become a term-of-art under NEPA. FAA guidance (5050.4B, Para 509c) provides assistance to identifying connected actions; while this text is in the context of scoping an EIS, the same principles occur regarding categorical exclusions and EAs. Specifically, an enabling action is an action that is required to be undertaken so as to enable the action the sponsor is pursuing. Generally, the actions are connected if: (a) one action automatically triggers the other action(s); or (b) one action cannot or will not occur unless other action(s) are undertaken. Finally, if any of the variables above change once an environmental documentation approach or strategy is established, the environmental processing approach would likely need to be reassessed and potentially change.

7.3.4 NEPA Strategy for RDP Projects

Based on a review of RDP and the CIP, the substantial majority of projects would be eligible for a Categorical Exclusion. Table 7-4 lists the applicable paragraphs of Order 1050.1F that would apply, assuming there are no extraordinary circumstances. Additional caveats are noted relative to certain projects.

Table 7-4

PROBABLE ENVIRONMENTAL PROCESSING FOR RECOMMENDED DEVELOPMENT PLAN AND CAPITAL IMPROVEMENT PROGRAM

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

		Project Timing								
Source	Project Description	2016-20 (Near term)	2021-25 (Mid-term)	2026-30 (Mid-term)	2031-35 (Long-term)	FAA Funding	ALP Mod	Federal action	1050.1F CatEx	CatEx Caveat
Airfield										
CIP	Runway 3L-21R and Associated Taxiways Reconstruction and 21R Deicing Reconstruction	xx				-			5.6-4e	
CIP	Runway 3L-21R Enhancements Planning	xx				Yes		Yes	5.6-1o	Only the plan
CIP	Taxiway M3, M4 and Western Portion of Taxiway P4 Removal	xx					Yes	Yes	5.6-4e	no permanent change in runway use/180 days
CIP	Runway 21R Deicing Pad Reconstruction (design only)	xx				Yes		Yes	5.6-4d/e	1050.1F design caveat
CIP	Taxiway H Extension/Reconstruction and 22L Deicing Pad Expansion	xx				Yes	Yes	Yes	5.6-4d/e	no permanent change in runway use/180 days
CIP	Taxiway Kilo (K) Reconstruction Program	xx								
CIP	Airfield Pavement Rehabilitation/ Reconstruction Plan	xx				Yes		Yes	5.6-1o	Plan/construction under 180 days
CIP	McNamara Apron Rehabilitation/Joint Repairs	xx	xx							
CIP	Hangar 516 and 518 Apron Reconstruction	xx								
CIP	Taxilanes U-9 and Q Rehabilitation - Phase 1	xx								
CIP	McNamara Island Infill [2]	xx					Yes	Yes	5.6-4e	
RDP	Taxiway PP RON	xx					Yes	Yes	5.6-4e	No capacity increase
RDP	RON and apron pavements upon demolition of Smith Terminal		xx			Yes	Yes	Yes	5.6-4e	No capacity increase
RDP	Runway 22L De-Icing Pad reconfiguration		xx			Yes	Yes	Yes	5.6-4d/e	
RDP	ROFA - 9R, 21L and 27R			xx			Yes	Yes	5.6-3b/c, 5.6-4k/o	
RDP	Runway Incursion Mitigation Projects						Yes	Yes	5.6-4e	
RDP	Taxiway F Geometry (includes Taxiway G removal)	xx				Yes	Yes	Yes	5.6-4e	
RDP	Taxiway H Bridge			xx			Yes	Yes	5.6-4e	

Table 7-4 *(continued)*

PROBABLE ENVIRONMENTAL PROCESSING FOR RECOMMENDED DEVELOPMENT PLAN AND CAPITAL IMPROVEMENT PROGRAM

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

		Project Timing								
Source	Project Description	2016-20 (Near term)	2021-25 (Mid-term)	2026-30 (Mid-term)	2031-35 (Long-term)	FAA Funding	ALP Mod	Federal action	1050.1F CatEx	CatEx Caveat
Airfield *(continued)*										
RDP	Taxiway K Geometry		xx				Yes	Yes	5.6-4e	
RDP	Taxiway U Bridge			xx			Yes	Yes	5.6-4e	
RDP	Taxiway W Geometry			xx			Yes	Yes	5.6-4e	
RDP	Taxiway W2 Geometry			xx			Yes	Yes	5.6-4e	
RDP	Taxiway V2 Removal			xx			Yes	Yes	5.6-4e	
RDP	Taxiway Y3 Demolition			xx			Yes	Yes	5.6-4e	
RDP	Taxiway Y5 Geometry				xx		Yes	Yes	5.6-4e	
RDP	Taxiway K7 Geometry				xx		Yes	Yes	5.6-4e	
RDP	Closed taxiway pavement removal and service road reconstruction	xx				Yes	Yes	Yes	5.6-4a/e	
Ground Access and Parking										
CIP	Rogell-Dingell Connector	xx					Yes	Yes	5.6-4a	
RDP	Big Blue Deck Expansion (2000 spaces)			xx			Yes	Yes	5.6-4h	No capacity increase
RDP	Parking Exit Reconfiguration	xx					Yes	Yes	5.6-4h	
RDP	Future Development	xx					Yes	Yes	5.6-4h/f	
RDP	North Terminal Exit Roadway Reconfiguration (after demo of Smith Terminal)		xx				Yes	Yes	5.6-4a	
RDP	Eureka Express Lot		xx					Yes	5.6-4h	Avoid water resources on the site
CIP	Dingell Drive Retaining Wall Reconstruction	xx								
CIP	Bridges and Roadways Rehabilitation Program	xx								
CIP	Rogell and Burton Drive Intersection Reconfiguration	xx					Yes	Yes	5.6-4a	
CIP	Roadway LED Lighting Installation	xx								

Table 7-4 *(continued)*

PROBABLE ENVIRONMENTAL PROCESSING FOR RECOMMENDED DEVELOPMENT PLAN AND CAPITAL IMPROVEMENT PROGRAM

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

Source	Project Description	Project Timing 2016-20 (Near term)	2021-25 (Mid-term)	2026-30 (Mid-term)	2031-35 (Long-term)	FAA Funding	ALP Mod	Federal action	1050.1F CatEx	CatEx Caveat
Ground Access and Parking *(continued)*										
CIP	Lucas Drive Enhancements	xx								
CIP	West Service Drive Improvements and Relocation	xx					Yes	Yes	5.6-4a/e	
CIP	Fleet and Heavy Equipment Acquisitions	xx								
CIP	Compressed Natural Gas Fueling Facility	xx	xx				Yes	Yes	5.6-4f	
CIP	Master Plan Update	xx				Yes		Yes	5.6-1o	
CIP	Big Blue Parking Deck Rehabilitation - Phase 3	xx								
CIP	Big Blue Parking Deck Rehabilitation - Phase 4	xx	xx							
CIP	McNamara Parking Deck Rehabilitation	xx								
CIP	McNamara Terminal Deck Rehab. - Phase 2	xx	xx							
CIP	Surface Lots LED Lighting Installation	xx								
CIP	North Terminal GTC Third Elevator and Escalator	xx								
CIP	Parking Lot Rehabilitation	xx								
CIP	Parking System Replacement	xx								
Terminals and Security										
CIP	North Terminal Gate Expansion	xx					Yes	Yes	5.6-4h	No capacity increase
CIP	North Terminal Interior Wall Panel Replacements	xx								
CIP	McNamara Terminal CBP CCTV	xx								
CIP	Vehicle Checkpoint Enhancements - Sally Ports	XX								
CIP	Perimeter Fencing Cable Reinforcement	xx								
CIP	Checkpoint #1 Vehicle and Truck Screening Building	xx					Yes	Yes	5.6-4f	
CIP	Security System and Network Upgrades - Phases 2 through 5	xx								

Table 7-4 *(continued)*

PROBABLE ENVIRONMENTAL PROCESSING FOR RECOMMENDED DEVELOPMENT PLAN AND CAPITAL IMPROVEMENT PROGRAM

Airport Master Plan Update

Detroit Metropolitan Wayne County Airport

		Project Timing								
Source	Project Description	2016-20 (Near term)	2021-25 (Mid-term)	2026-30 (Mid-term)	2031-35 (Long-term)	FAA Funding	ALP Mod	Federal action	1050.1F CatEx	CatEx Caveat
Support Facilities, Site Development, Utilities and Miscellaneous										
RDP	Maintenance Facility Reconstruction		xx				Yes	Yes	5.6-4f	
RDP	Maintenance Facility - satellite location	xx					Yes	Yes	5.6-4f	
RDP	Non-perishable goods storage facility						Yes	Yes	5.6-4f	
CIP	East Service Drive Utilities Upgrade and Expansion	xx								
CIP	Utility Command Center and Remote Metering	xx								
CIP	Primary Electrical Cable and Switchgear Replacement	xx								
CIP	North Power Plant Electrical Gear and Load Centers Replacement	xx								
CIP	Electrical Substations Replacement	xx								
CIP	North Power Plant Chillers and Support Systems	xx								
CIP	North Power Plant HVAC / Air Handler and Miscellaneous Improvements	xx								
CIP	South Power Plant Site Generators	xx	xx							
CIP	Primary Electrical Loops Nos. 1-3 Upgrade and Expansion	xx								
CIP	North Power Plant Building Rehabilitation	xx								
CIP	McNamara Terminal HVAC Re-commissioning Study	xx								
CIP	Rental Car Facilities Study	xx								
CIP	Building 715 (Former NWA/DL Hangar) Demolition	xx					Yes	Yes	5.6-4i	
CIP	Buildings 714, 714A and 714B (Former Metro Flight Buildings) Site Redevelopment and demolition	xx	xx				Yes	Yes	5.6-4f/i	

Table 7-4 *(continued)*
PROBABLE ENVIRONMENTAL PROCESSING FOR RECOMMENDED DEVELOPMENT PLAN AND CAPITAL IMPROVEMENT PROGRAM
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Source	Project Description	Project Timing 2016-20 (Near term)	2021-25 (Mid-term)	2026-30 (Mid-term)	2031-35 (Long-term)	FAA Funding	ALP Mod	Federal action	1050.1F CatEx	CatEx Caveat
Support Facilities, Site Development, Utilities and Miscellaneous *(continued)*										
CIP	Building 534 (Former Flight Kitchen) Demolition	xx					Yes	Yes	5.6-4i	
CIP	Building 358 (Former Police Station) Demolition	xx					Yes	Yes	5.6-4i	
CIP	LC Smith and Berry Terminals Demolition	xx					Yes	Yes	5.6-4i	
CIP	Airport Authority Headquarters Building	xx					Yes	Yes	5.6-4f	
CIP	Roof Replacement	xx	xx							
CIP	Building 348 (Executive Terminal) Partial Restoration	xx					Yes	Yes	5.6-4f	Section 106 compliance and potentially DOT 4(f) statement
CIP	Fire Training Facility Restoration and Burn Pit Replacement	xx				Yes	Yes	Yes	5.6-4f	
CIP	ARFF Station 100 Improvements	xx								
CIP	Water Main Replacement	xx								
CIP	Primary Pump and Switchgear Replacements	xx								
CIP	Storm and Sanitary Sewer Systems Replacements	xx								

Chapter 8
FINANCIAL PLAN

To ensure the viability of the proposed RDP, it is necessary to determine its affordability. This chapter presents a summary of the financial framework governing the Airport, funding sources identified for capital projects, and a financial feasibility study of the proposed RDP, including analysis of current debt levels, project costs, and the effect of future debt issuances on key financial metrics. This chapter is organized as follows:

- Financing Capacity
- Relevant Documents and Laws
- Capital Projects and Funding Sources
- Feasibility Analysis
- Updated Financial Analysis

The Authority owns and operates Detroit Metropolitan Wayne County and Willow Run* airports and the Airport Westin Hotel.**

The analysis included herein addresses the implementation of both the Authority's existing 5-year CIP and projects included in the RDP summarized in Chapter 7. All financial results are presented for the Authority's Fiscal Years (FY) ending September 30.

Actual enplanements for FY2016 along with passenger growth forecasts presented in Chapter 3 were used for the financial analysis. Additional assumptions were made about passenger activity at the Airport because Passenger Facility Charges (PFC) revenue, entitlement grants from the FAA's Airport Improvement Program (AIP), certain non-airline revenue, and certain expenses are driven by passenger activity to varying degrees.

The analysis demonstrates that implementation of the CIP and the RDP does not cause significant increases in the specific key metrics in this forecast, given the various assumptions described herein. Such assumptions are considered to be appropriate and reasonable for the purposes of this Master Plan Update. However, inevitably, some assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there will be differences between the forecast and actual results, and those differences may be material. Master Plan findings are not intended to be used to support the issuance of bonds or to obtain other funding.

8.1 FINANCING CAPACITY

The existing financial capacity of the Airport was reviewed at the beginning of the master planning process based on factors including the unique characteristics of the existing airline agreements, bond documents, the Authority's current debt, revenues, expenses, and the current CIP. Using information provided by the Authority, including the 2016 the Authority Budget Book and the Series 2015D-G Official Statement a financial model was developed to demonstrate the Airport's current debt service levels and to estimate the debt service capacity available for future projects.

*The Authority is also undertaking a Master Plan Update for Willow Run to evaluate its future capital needs. Since no final decision has been made on the final costs or funding sources for Willow Run projects, these have been excluded from this analysis.

**From FY2017, the revenues, expenses and debt service of the Westin Hotel are included as part of the Airport's operations.

The Airport's five and ten year CIPs were reviewed to ensure the proposed timing and expected funding sources for the projects aligned with the Authority's goal of maintaining a Cost per Enplaned Passenger (CPE) that is both manageable and competitive in relation to other airports.

The 2016 Budget Book calculated the 2016 CPE for the Airport to be $10.32, around the average for large-hub airports in the U.S. The 2016 Budget Book showed the Authority had just over $2 billion in outstanding debt, with annual debt service payments ranging between approximately $140 million and $160 million per year over the next decade. Annual debt service does not fall below $100 million until after 2028.

After estimating the timing and magnitude of future bond issuances required to fund the balance of the CIP, it was determined that there would still be capacity to fund the RDP projects and maintain a CPE (in real terms)* with a CPE at or below $11.00.

The RDP identifies capital project costs of $483 million (in 2016 dollars) in addition to the CIP, with an estimated $281 million to be funded with debt. From 2016 to 2020, $44 million of debt-funded projects would be undertaken, with an additional $157 million in 2021 to 2025, and the final $79 million after 2026.

The feasibility analysis indicated that $50 million of debt funded project capacity exists by 2018 while maintaining an $11.00 (real) CPE, $300 million by 2023, and in excess of $1 billion of projects post-2028.

These results indicate that, based on the assumptions used in the feasibility analysis, available debt capacity exceeds expected debt funding needs for the RDP.

On receipt of the Authority's 2017 Budget Book, updated projections for revenues, expenses, debt service, and project funding sources were analyzed, confirming that the RDP remains affordable.

8.2 RELEVANT DOCUMENTS AND LAWS

The Airport functions as an operating unit of the Authority and is governed or influenced by the following:

- Aeronautics Code of the Michigan Public Airport Authority Act, being MCL 259.108 – 259.125c, (the "Aeronautics Code"), which vests the Authority with the power to undertake management and operation of the Airport. The Authority was created no March 26, 2002, via an amendment to this Code.
- Master Airport Revenue Bond Ordinance (Master Bond Ordinance) adopted by the Board of the Authority on September 26, 2003, as amended, which provides conditions for the issuance of Senior and Junior Lien Bonds to finance construction and repair projects, including, the application of revenues, the payment of operating expenses and payment of debt service.
- Agreements with airlines providing for use of the Airport and the payment of terminal rentals, ramp fees, landing fees, and certain other charges.
- Concession agreements, leases, contracts, and permits with various tenants, users, and providers of services at the Airport.
- The Federal Aviation Administration's Aviation Safety and Capacity Expansion Act of 1990 (The PFC Act) which provides approvals to collect and use Passenger Facility Charge (PFC) receipts, and the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR 21) which authorizes PFC collections at a $4.50 level.

*As projects identified in the RDP are shown in 2016 dollars and not escalated for inflation through to their estimated construction date, the feasibility model calculating revenues, expenses and CPE, are also in real, or uninflated dollars.

- Federal statutory and constitutional provisions, including the Aviation and Transportation Security Act, the Anti-Head Tax Act of 1973, the Airport and Airways Improvement Act of 1982, the Interstate Commerce Clause, and the PFC Act of 1990.
- U.S. Department of Transportation policies mandated by the FAA Act of 1994, related to airport rates and charges, rules for resolving disputes, and revenue diversion.
- Generally accepted accounting principles.
- Various policies adopted by the Authority.

Discussion of key documents and laws is provided in the following sections.

8.2.1 Master Bond Ordinance

As per the 2016 the Authority Budget Book, the Authority had just over $2.03 billion in outstanding debt, consisting of $1.865 billion in Senior Lien Bonds and $166 million in Junior Lien Bonds.

The Master Bond Ordinance authorizes the Authority to fix, charge, and collect rates, fees, rentals, and charges for the use and operation of the Airport as necessary or appropriate to produce revenues sufficient to meet the obligations of the Authority. These obligations include operating and maintenance expenses, deposits to various accounts for payment of debt service, reserve funds, discretionary or development funds, and amounts sufficient to meet debt service coverage requirements.

The Master Bond Ordinance also outlines the flow-of-funds, which determines the prioritization of cash outflows. The highest priority is a deposit into the Revenue Fund to provide a credit requirement of twenty-five percent of debt service on all outstanding bonds.

Upon satisfaction of that requirement, operation and maintenance expenses are the next priority, followed by principal and interest on the senior bonds, then the junior bonds. Following the payment of outstanding debt, remaining funds are then placed into the four accounts in order of priority; an operation and maintenance reserve fund, a renewal and replacement fund, a discretionary airport fund, and an Airport development fund.

8.2.2 Airline Agreement

As of September 2016, the Airport had nine signatory airlines that have entered into Airport Use and Lease Agreements that expire in 2032. These include Air France, American Airlines, Delta Air Lines, Federal Express, Lufthansa German Airlines, Southwest Airlines, Spirit Airlines, United Airlines, and United Parcel Service. These Agreements set the terms for the use of the Airport, the lease of terminal space and facilities, and establish the payment of terminal rentals, activity fees and other airline fees and charges.

The Authority has two actively leased terminals – McNamara Terminal and the North Terminal. Delta and its code share partners and subsidiaries currently lease the majority of the airline space in the McNamara Terminal on a preferential basis, while each of the signatory airlines operating from the North Terminal lease gate holdroom, ticket counters and other airline operational space on a preferential use basis. The Authority maintains holdroom and ticket counter space that is available to other airlines on a shared use basis. Terminal rental rates are determined according to a residual rate making methodology included in the Airline Use and Lease Agreements. Under the Agreement, two terminal cost centers are established with operating and maintenance costs, and debt service allocated to each.

The Authority calculates airline landing fee rates under an Airport-wide residual methodology. Activity Fee rates are determined by calculating the net operating cost of the entire Airport, less airline rates, non-airline revenues, and non-operating revenues.

The signatory airlines guarantee the net cost of operating the entire Airport, including operating expenses and all debt service and coverage requirements. If the Authority realizes a surplus in any year, the Authority must refund the surplus to the Signatory Airlines. Conversely, if the Authority incurs a deficit, activity fees imposed on airlines can be increased up to the amount of the deficit.

The Airline Agreement also contains a majority in interest (MII) provision, which allows signatory airlines the right of approval over capital projects that necessitate the issuance of revenue bonds. The Agreement requires that a weighted majority approve the project, essentially providing the airlines with control over any large-scale capital projects undertaken by the Authority, and the resulting impact on facility rents and activity fees.

8.2.3 Non-airline Revenues

The Authority has entered into numerous agreements with concessionaires and other tenants for the operation of concessions and other services at the Airport including, among others, food and beverage, gift and merchandise, rental car, duty free, advertising, hangars, cargo facilities, office space, parking, and ground transportation services.

The Authority also receives revenue for services such as employee badging, maintenance, and ambulance services as well as recovery of utilities, and fines and penalties. Non-airline revenues are used as a credit to offset terminal and airfield costs to airlines. Budgeted Non-airline revenues for FY2016 were $145.6 million, increasing to $187 million in FY2017 with the inclusion of the Hotel.

8.2.4 Passenger Facility Charges

The Passenger Facility Charge Act authorizes the Authority to impose a PFC of up to $4.50 for each qualifying enplaned passenger, which can be used to fund eligible Airport-related projects. All projects must be approved by the FAA, with applications also subject to an airline consultation process as well as a public comment period. The Authority has collected PFCs at the Airport under six applications since 1992. The current authorization expires in 2034 and allows the Authority to collect a $4.50 fee per enplaned passenger, less a $0.11 handling fee retained by the airlines.

The Authority has the authorization to impose and use $3.2 billion in PFCs. As of September 30, 2016, the Authority had collected approximately $1.3 billion in PFC revenues and an additional $73.5 million in interest earnings under these authorizations.

These PFC revenues are irrevocably committed to the payment of debt service on approved capital projects, which lowers the net cost to airlines, reducing overall rates and charges at the Airport.

8.2.5 Airport Improvement Program Grants

Airport Improvement Program (AIP) Grants are provided by the federal government to fund eligible projects at airports included in the National Plan of Integrated Airport Systems. For airports classified as large-hubs (as is the Airport), the program funds up to seventy-five percent of eligible costs for projects such as airfield planning and development and up to eighty percent for noise mitigation projects.

AIP Grants fall under two categories – entitlements and discretionary. Dollar amounts for entitlements are calculated on a formula based on each U.S. airport’s share of system-wide passengers and cargo throughput; discretionary grants are typically awarded based on the project's priority compared to other eligible projects at airports throughout the system.

As shown in Table 8-1, between FY 2005 and FY 2016, the Authority received $324.7 million, or an average of $27.0 million per year in AIP (both entitlement and discretionary) grants.

Table 8-1
HISTORICAL AIP FUNDING (IN MILLIONS)
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Fiscal year	AIP funds
2005	37.7
2006	40.3
2007	52.3
2008	27.5
2009	34.5
2010	21.9
2011	18.1
2012	24.1
2013	8.1
2014	25.5
2015	14.0
2016	20.7
Total AIP funds received	324.7

8.3 CAPITAL PROJECT COSTS AND FUNDING SOURCES

As described in Chapter 7, the RDP identifies an additional $483 million of capital projects during the 20-year planning horizon, in addition to the current 5-year, $804 million CIP developed by the Authority. The following feasibility analysis considers the cost of both the RDP and CIP in order to evaluate overall affordability.

Table 8-2 summarizes the estimated costs and construction timeline for the CIP projects identified in Chapter 7. Table 8-3 shows similar details for the RDP projects. Although all CIP and RDP projects are included in the analysis, some projects in the CIP and RDP may be deferred or deleted if forecast demand does not materialize, facility requirements otherwise change, project costs increase, or anticipated funding is not available. Conversely, projects may be implemented earlier and other projects added if demand warrants and funding is available.

Funding sources for the CIP are based on information contained in the 2016 Budget Book, while assuming that the RDP is funded from a mix of AIP Grants and future bonds. Table 8-1 showed that the Authority has received an average of $27 million per year in entitlement and discretionary funding. It is assumed that similar levels of funding will be available in future years for eligible projects. Airfield projects can be funded up to 75% from AIP grants if determined to be a high priority by the FAA. Many of the airfield projects shown in the RDP are required to meet updated safety standards or regulations set by the FAA. Therefore, if certain projects are deemed essential by the FAA, it is assumed that future discretionary AIP funds would be made available to assist with their implementation. If they are not considered urgent, or do not pose an immediate safety or operational risk, then they could be deferred until AIP funding is available.

Table 8-2
CAPITAL IMPROVEMENT PLAN PROGRAM COSTS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Project type	Estimated project cost	Projected expenses to 9/30/2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021+
Airfield	$464.9	$36.2	$70.2	$88.8	$63.4	$191.4	$15.0
Cargo, hangar and commercial development	7.9	1.3	0.9	--	0.5	5.2	--
Power plants and electrical distribution system	55.9	9.0	25.3	9.8	2.4	5.7	3.8
Fleet and equipment	41.9	18.7	4.0	5.6	6.6	4.9	2.2
Parking and ground transportation facilities	58.6	6.8	6.9	9.5	11.7	5.2	18.5
Bridges and roadways	44.4	11.1	20.5	8.8	2.0	2.0	--
Security and communications	31.1	3.2	5.0	6.3	7.6	9.0	--
Support facilities	35.6	13.1	15.1	5.4	0.2	1.7	0.3
Site redevelopment and demolitions	27.8	7.4	5.2	6.2	5.3	2.2	1.4
Terminals	21.9	--	0.9	21.0	--	--	--
Water mains and storm water system	7.6	4.5	1.1	2.1	--	--	--
Other projects	6.2	2.0	3.2	1.0	--	--	--
CIP total	$803.9	$113.3	$158.2	$164.3	$99.6	$227.3	$41.2

Source: Wayne County Airport Authority, as approved by the Authority board, September 2016.

The balance of the RDP is assumed to be funded from future bond issuances, as the Authority has limited means to fund projects from other sources in the near and medium term. PFCs are fully pledged to pay existing debt service through at least 2032, and the current Airline Agreement limits the Authority's ability to generate surpluses and accumulate significant amounts of cash for discretionary purposes. All future revenues generated from non-airline sources are assumed to be offset against Airport costs in accordance with the current Agreement, and unavailable for capital projects.

Table 8-3
RECOMMENDED DEVELOPMENT PLAN FUNDING SOURCES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	AIP funds ($M)					Debt ($M)					Total
Category	2016-20	2021-25	2026-30	2031-35	Total	2016-20	2021-25	2026-30	2031-35	Total	RDP
Airfield	$96.1	$63.0	$38.1	$4.9	$202.1	$32.0	$21.0	$12.7	$1.6	$67.4	$269.5
Parking and ground transportation facilities	--	--	--	--	--	3.7	9.7	65.0	--	78.4	78.4
Bridges and roadways	--	--	--	--	--	1.2	--	--	--	1.2	1.2
Support facilities	--	--	--	--	--	--	10.0	--	--	10.0	10.0
Site redevelopment and demolitions	--	--	--	--	--	7.2	116.4	--	--	123.6	123.6
Total project cost by period	$96.1	$63.0	$38.1	$4.9	$202.1	$44.2	$157.1	$77.7	$1.6	$280.6	$482.7

Source: LeighFisher, March 2017.

As noted above, the airlines have MII approval rights for any projects to be funded from Airport revenue bonds. Therefore, for any of the projects not assumed to be funded with AIP grants, the Authority would need to demonstrate to the signatory carriers that there are operational benefits, safety improvements, cost savings, revenue enhancements, or other reasons why the project should proceed.

For the feasibility analysis, it is assumed that all debt funded projects are neutral in terms of Authority revenues and expenses. In reality, expenditures on fleet and equipment upgrades could reduce operational and maintenance costs, commercial development projects improve revenues, etc. As these effects are difficult to quantify, to be conservative, they are assumed to be zero.

8.4 FEASIBILITY ANALYSIS

The feasibility analysis was developed based on information received from the Authority, publicly available resources, and assumptions made by LeighFisher. A financial model was developed which combined these inputs and projected Airport expenses, non-airline revenues, net debt service requirements, enplaned passengers, CPE, and available funding capacity.

8.4.1 Key Assumptions

The feasibility analysis utilized the following inputs and assumptions:

- **Passenger traffic** – As described in Chapter 3, near-term annual growth is forecast at 1.5 to 3%, decreasing to between 1.1 and 1.25% in the medium- and longer-term. This averages to an annual growth rate of 1.3% through 2035.

- **Inflation** – As projects identified in the RDP are shown in 2016 dollars and not escalated for inflation through to their estimated construction date, the feasibility model is also in real, or uninflated, dollars.

- **Operating Expenses** – increases are driven by higher passenger throughput, not inflationary cost increases. A base year operating cost per enplanement was calculated ($12.56), and multiplied by the projected number of enplanements. No reduction in costs per enplanement was assumed for either efficiencies or economies of scale.

- **Non-airline Revenue** – growth is also based on throughput, not inflation, using a baseline revenue per enplaned passenger rate of $8.72. This was assumed to increase at a rate of 0.25% per year based on the Authority's ability to negotiate improved contract terms, enhance product offerings to drive higher sales, and increase occupancy levels. The resulting annual rate was multiplied by projected passengers for the year to calculate total Non-airline Revenue.

- **Airline Agreement** – the flow of funds and residual nature of the Agreement remains unchanged throughout the projection period.

- **Airport Hotel** – As the FY2016 budget was used for the initial feasibility study, hotel revenues, expenses, and debt service were excluded from this analysis, as this was a separate entity within the Authority, and not considered as part of the Airport's cash flows.

- **Existing Debt Service** – Existing debt service was obtained from the Authority 2016 Budget Book.

- **PFCs** – These remain pledged to existing debt service. It is projected that annual PFC collections would exceed existing annual debt service on existing debt around 2032, at which time it would be applied to debt issued to fund the CIP. It is assumed that there are PFC eligible projects within the CIP.

- **2015 Issuance** – Subsequent to the drafting of the 2016 Budget Book, the Authority completed a $520 million refinancing/bond issue. $220 million of new money from these bonds was used to fund projects in the CIP.

- **Assumed 2017 Issuance** – Per the 2016 Budget Book, the Authority had $387 million of cash on hand from previous bond sales and planned a further debt issuance later in 2017 to fund $166 million of CIP project costs. It was assumed that this issuance would have a 30-year term, an all-in interest rate of 4.25%, and issuance costs of 15%. There would also be a deferred interest period of 3 years to prevent a significant spike in airline costs, followed by a period of increasing, then level debt service over the remaining life of the bonds.

8.4.2 Preliminary Financial Projections

Table 8-4 presents projections of key financial results which were performed prior to the development of the RDP. Therefore, these results are based on the above assumptions and take into account the funding of the current CIP, but <u>exclude</u> the RDP. New CIP debt increases to fund the ongoing CIP, while O&M, Non-Airline Revenues, and PFCs move in line with passenger growth.

Actual enplaned passengers for FY2016 exceeded 17 million, surpassing budgeted levels, and are projected at 17.2 million for FY2017. This contributes to a lower projected CPE for 2017 ($11.00) than the Budget Book ($11.12).

Real CPE is projected to be $10.75 for 2018 and then to decline in future years as net debt service decreases over time and the number of enplaned passengers increases. This indicates that there is available debt capacity to fund the RDP projects while maintaining a real CPE below $11.00.

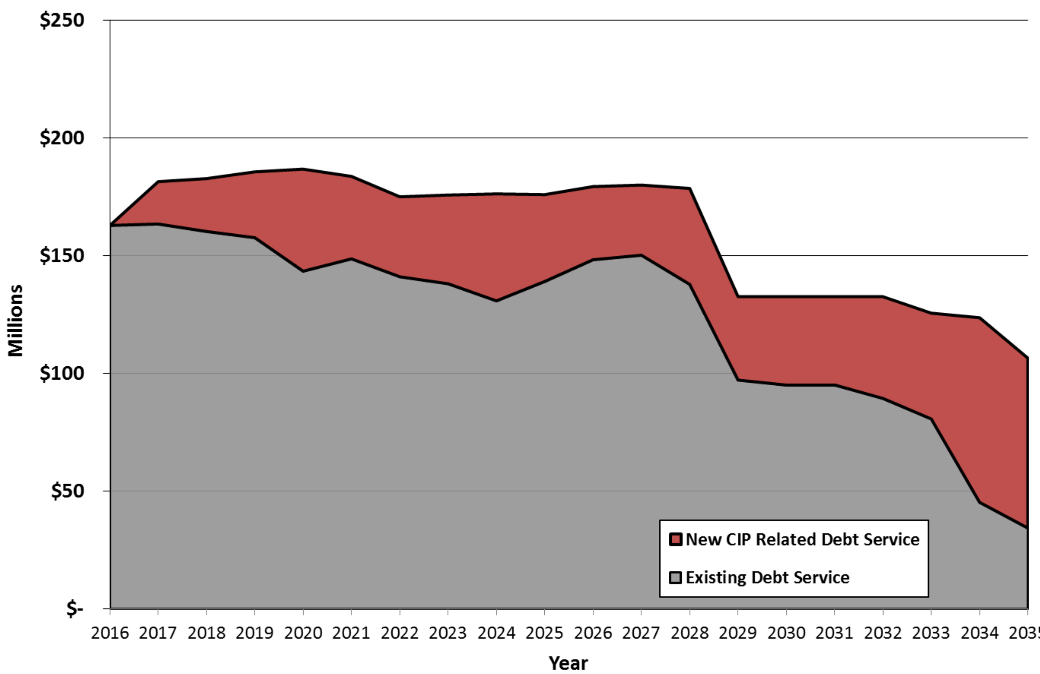
Table 8-4
PROJECTED AIRLINE REQUIREMENTS AND COST PER ENPLANED PASSENGER
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport
(in thousands, except rates, 2016 dollars)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035
Net Airline Requirement											
O&M	216,053	219,469	222,798	226,300	229,538	232,750	235,873	238,658	241,511	256,476	271,925
Existing Debt	163,482	160,321	157,668	143,435	148,685	141,077	138,111	130,840	139,076	95,061	34,308
New CIP Debt	18,017	22,468	27,989	43,374	35,039	33,963	37,689	45,458	36,907	37,620	72,177
Airport Development Fund	5,935	6,169	6,410	6,658	6,913	7,177	7,451	7,736	8,031	9,686	11,683
Airport Discretionary Fund	350	350	350	350	350	350	350	350	350	350	350
Less Non-Airline Revenue	147,459	152,722	155,426	158,264	160,929	163,590	166,199	168,582	171,023	183,903	197,429
Less PFCs for Existing Debt Service	67,214	68,277	69,313	70,402	71,409	72,409	73,380	74,247	75,134	79,790	34,308
Less PFCs for New Debt Service	-	-	-	-	-	-	-	-	-	-	50,288
Net Airline Requirement	189,163	187,778	190,476	191,452	188,186	179,319	179,895	180,213	179,717	135,501	108,417
Enplaned Passengers	17,203	17,475	17,740	18,019	18,277	18,533	18,781	19,003	19,230	20,422	21,652
Airline Cost Per Enplaned Passenger	$ 11.00	$ 10.75	$ 10.74	$ 10.62	$ 10.30	$ 9.68	$ 9.58	$ 9.48	$ 9.35	$ 6.64	$ 5.01

Source: WCAA 2016 Budget, WCAA 2015 Official Statement and LeighFisher

Figure 8-1 below illustrates the Authority's existing debt service per the 2016 Budget Book as well as the incremental debt service from both the Series 2015D-G issuance and an assumed 2017 issuance to fund CIP projects. The Series 2015D-G bonds incurred an additional $220 million of debt to fund ongoing CIP projects, while refinancing $300 million in existing debt. The 2017 issuance is assumed to incur $191 million of additional debt. Together, these issuances are projected to increase annual debt service to between $175 million and $185 million per year over the next decade.

Figure 8-1
ANNUAL DEBT SERVICE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

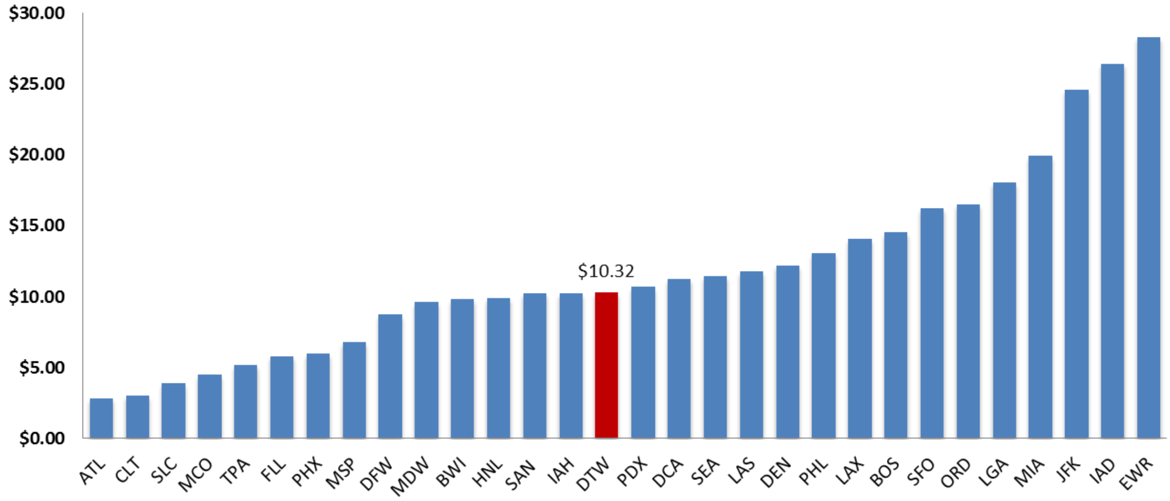


Source: Wayne County Airport Authority 2016 Budget Book, Series 2015D-G Official Statement, and LeighFisher.

8.4.3 Cost Per Enplaned Passenger

A key industry metric used to evaluate and compare the relative costs of an airport is cost per enplaned passenger (CPE). This metric is calculated by adding all payments made by passenger carriers for terminal rents, landing fees, common area charges, and other applicable charges, and dividing by the total number of enplaned passengers at the airport. The Authority has expressed the desire to keep airline CPE competitive with other large U.S. hub airports. This is both for the purpose of maintaining existing carriers and attracting new entrants to the market.

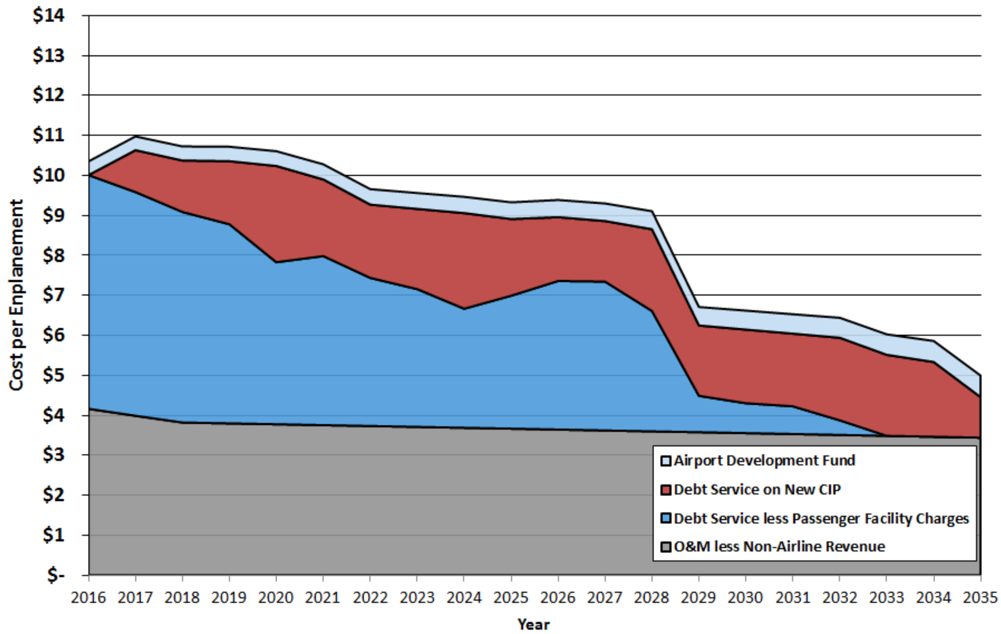
Figure 8-2
COMPARISON OF COST PER ENPLANED PASSENGER AT OTHER AIRPORTS
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: LeighFisher CPE database, S&P reports, Fitchrating reports, Moody's reports, AND FAA CATS FORM 127

The 2016 Budget Book estimated that CPE in 2016 would be $10.32, placing the Airport around the average for all U.S. large-hubs. The 2016 Budget Book also shows CPE increasing to $11.12 in 2017 and $11.30 in 2018. Given the age and condition of the Airport's terminals and airfield, the combined CIP and RDP is not excessive compared to other large-hubs. In future years, this will likely improve the Airport's competitive position compared to other airports, which will face rising costs associated with the implementation of larger capital programs.

Figure 8-3
COMPONENTS OF THE AIRPORT'S CPE
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: Wayne County Airport Authority 2016 Budget Book, Series 2015D-G Official Statement, and LeighFisher.

Figure 8-3 illustrates the key components of the Airport's CPE, along with projections for future CPE. Net O&M (after subtracting Non-Airline Revenue) is projected to remain essentially flat throughout the 20-year period of the study as both are tied to enplaned passenger growth. Due to existing debt service decreasing in future years and growing enplanements, CPE is projected to fall, with a significant reduction occurring in 2029. The differences between the CPE above and that shown in the 2016 Budget Book are due to differences in traffic projections, as well as the nominal (inflated) values shown in the Budget Book versus the real CPE shown below.

Net debt service currently comprises around $6.00 of the of this per-passenger amount, while net O&M costs make up around $4.00. Airport Development/Discretionary Funds comprise approximately $0.30 for 2016.

8.4.4 Feasibility Analysis Findings

As demonstrated on Figure 8-3, if the Authority wished to maintain a CPE at or below $10.00, there would be minimal ability to issue additional debt before 2022, with significant capacity only occurring after 2028. However, at a CPE of $11.00, there is currently capacity to issue debt to fund approximately $50 million of RDP projects as early as 2018, in addition to those identified in the CIP.

Figure 8-4
ADDITIONAL ANNUAL DEBT SERVICE
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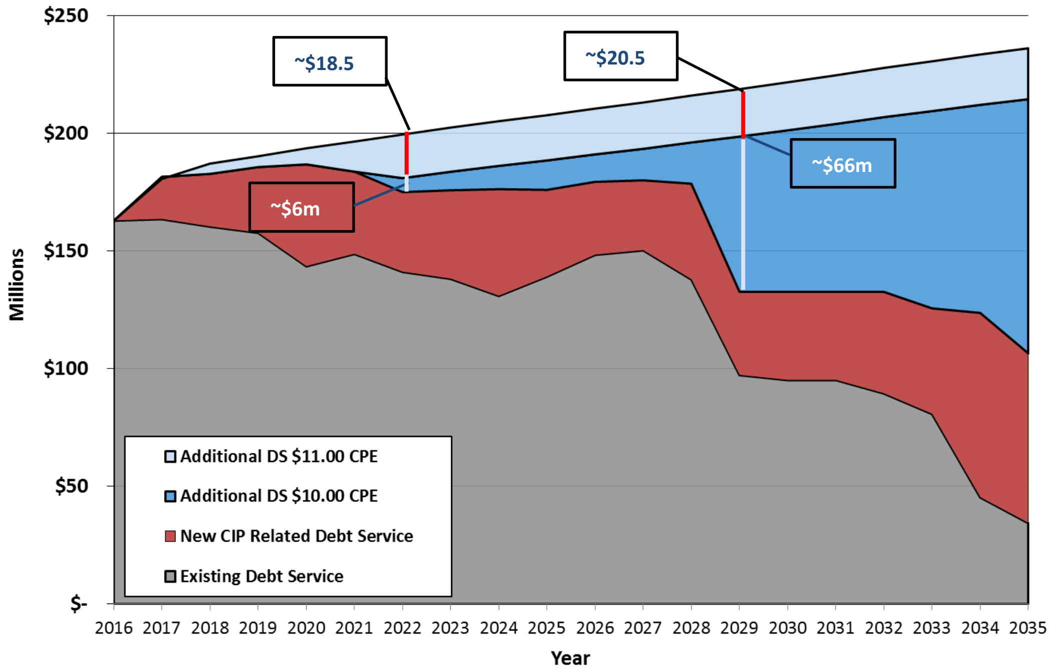
Detroit Metropolitan Wayne County Airport



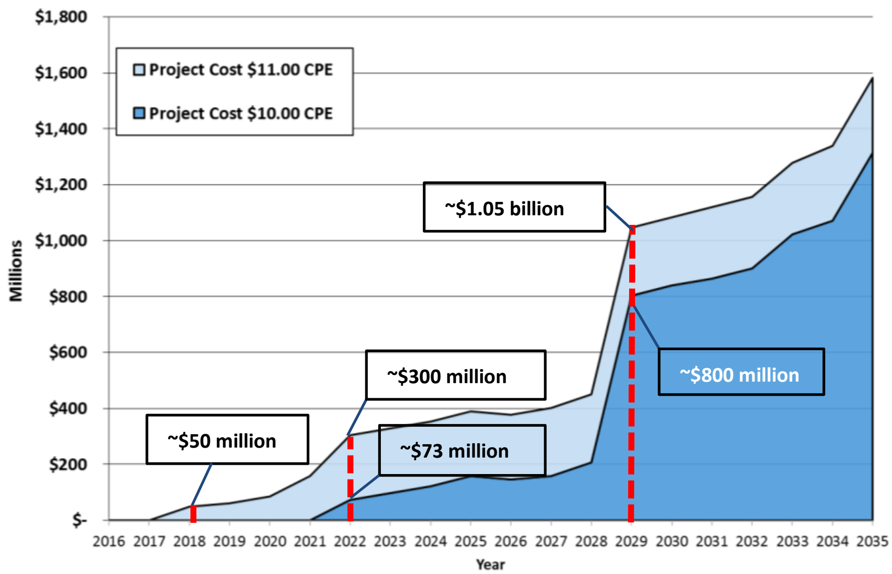
Source: Wayne County Airport Authority 2016 Budget Book, Series 2015D-G Official Statement, and LeighFisher.

As indicated in Table 8-4, by 2022 CPE is projected to fall below $10.00 in 2022. At a projected CPE level of $9.68, this could provide an additional $0.32 towards debt service while remaining at a $10.00 level. Figure 8-4 above shows that this increase in CPE could fund an additional $6 million of debt service per year. An increase in the CPE of another $1.00 up to $11.00 could support a further $18.5 million additional annual debt service for a total of $24.5 million in available debt service capacity in 2022.

By 2029, a projected CPE of less than $7.00 could provide capacity for an additional $66.0 million of annual debt service while keeping CPE below $10.00, and a further $20.5 million at $11.00, for a total of $86.5 million.

Figure 8-5 illustrates how much project funding is available if CPE capacity up to $10.00 or $11.00 is used for debt service. The additional $6.0 million of debt service available in 2022 at a $10.00 CPE identified in Figure 8-4 could fund approximately $73.0 million of project costs, and an additional $24.5 million of debt service at an $11.00 CPE could fund $300.0 million in project costs. By 2029, the additional $66.0 million of debt service could fund $800 million in projects while maintaining a $10.00 CPE level, and over $1 billion of projects at an $11.00 level.

Figure 8-5
AVAILABLE PROJECT FUNDING CAPACITY
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport



Source: LeighFisher.

Table 8-4 showed that, of the current RDP of $483 million, $281 million would need to be funded through debt issuances. Assuming that any new debt would be issued at the mid-point of each 5-year phasing period, approximately $44 million would be issued in 2018 and a further $157 million by 2022. A further issuance could occur in 2028 to fund $79 million of projects planned for the third phasing period. Table 8-5 shows the funding needs of the RDP over the three phasing periods through 2035 along with the available funding capacity based on an $11.00 CPE. This demonstrates that based on the inputs and assumptions used in this feasibility analysis, the RDP is affordable.

Table 8-5
RDP FUNDING NEEDS AND AVAILABLE CAPACITY
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

Phasing period	Planned issuance	RDP funding needs (millions)	Available capacity at an $11.00 CPE (millions)
2016-2020	2018	$44	$50
2021-2025	2022	$157	$300 (an additional $250)
2026-2035	2028	$79	$1,005 (an additional $705)

Source: LeighFisher.

8.5 UPDATED FINANCIAL ANALYSIS

After completion of the initial feasibility analysis, the Authority released its 2017 Budget Book. This provided updated guidance on revenues, expenses, debt service and CIP funding sources.

The updated numbers were reviewed for material changes that might impact the feasibility of the RDP.

FY2017 revenues are budgeted to be $187.0 million (including $21.0 million for the hotel), compared to $147.5 million for FY2017 in the 2016 Budget Book. This represents an $8.6 million increase from the prior budget when excluding the hotel.

FY2017 expenses are budgeted to be $246 million (including $19.3 million for the hotel), compared to $216 million for FY2017 in the 2016 Budget Book. This represents a $10.7 million increase from the prior budget when excluding the hotel.

The 2016 Budget book estimated FY2017 net airlines payments to be $186.8 million over 16.8 million enplanements for a CPE of $11.12. The 2017 Budget Book has this decreasing to $171.3 million, and when spread over a forecasted 17.3 million enplanements, equates to a CPE of $9.90, a reduction of $1.22 from the prior year budget.

Table 8-6 shows the funding sources identified for the CIP. The amount of projects to be funded from the 2017 Series bonds increased from $166 million in the 2016 Budget Book to $218 million. Plus, a further $360 million is identified for future bonds.

Table 8-6
CAPITAL IMPROVEMENT PLAN FUNDING SOURCES
Airport Master Plan Update
Detroit Metropolitan Wayne County Airport

	Estimated total costs	Grants	Previous bonds	Series 2017	Future bonds	Other
Airfield	$464.9	$--	$ 68.0	$128.0	$268.1	$ 0.9
Cargo, hangar ad commercial development	7.9	--	--	--	7.9	--
Power plants & electrical distribution system	55.9	--	34.4	9.3	11.6	0.6
Fleet and equipment	41.9	2.0	22.7	12.2	5.0	--
Parking and ground transportation facilities	58.6	--	13.5	6.0	35.9	3.2
Bridges and roadways	44.4	--	17.3	22.3	2.9	1.9
Security and communications	31.1	--	6.9	5.5	17.8	0.9
Support facilities	35.6	--	19.0	6.8	2.7	7.2
Site redevelopment and demolitions	27.8	--	10.3	6.3	8.8	2.4
Terminals	21.9	--	1.0	20.9	--	--
Water mains and storm water system	7.6	--	6.6	1.0	--	--
Other projects	6.2	4.6	--	--	--	1.6
CIP total	$803.9	$6.7	$199.6	$218.2	$360.7	$18.6

Source: Wayne County Airport Authority 2017 Budget Book.

The amount estimated to be funded from AIP grants is only $6.7 million over 5 years, compared to an average of $27 million over the last decade. Given that the majority of projects are airfield related, it is likely that discretionary grants should become available, in addition to the Airport's annual entitlements. This would reduce the amount of future bonds required, lowering the CPE.

Figure 8-6 shows the impact of the higher level of 2017 bonds, plus the future CIP issuance on CPE. It is assumed that future CIP bonds would be issued in 2020, at an interest rate of 4.25%, a 30 year term and 15% issuance costs. Debt Service for the RDP projects is also layered in, with planned issuances to fund project costs of $44 million in 2018, $159 million in 2022, and $79 million in 2028. Again, 30-year terms are used, but with a higher interest rate of 5.50% for the two later issuances.

This shows that even with the additional debt issuance in 2020 to fund the current CIP, a higher issuance in 2017 and limited reliance on AIP grants, the CPE still remains in a reasonable range of around $11.00 including both the CIP and the RDP.

Figure 8-6
UPDATED RDP AFFORDABILITY
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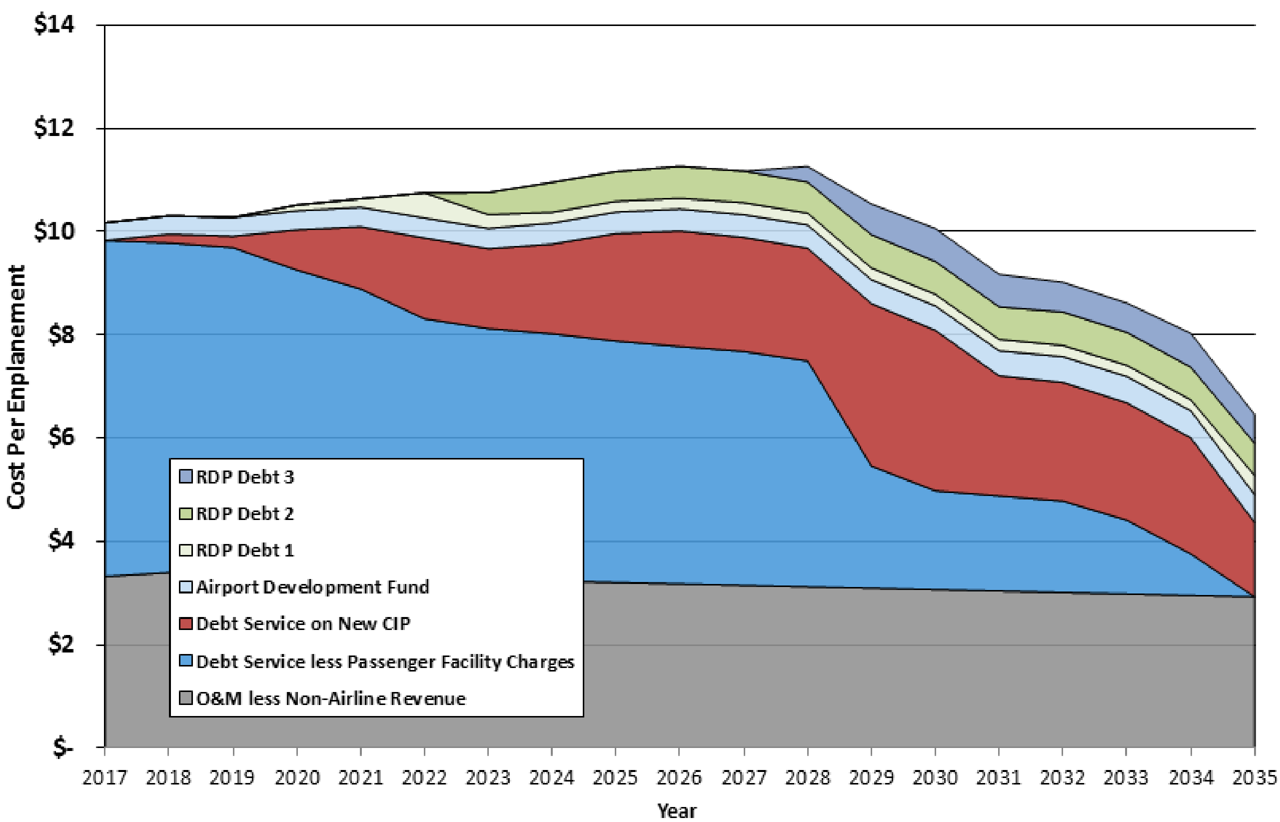
Detroit Metropolitan Wayne County Airport



Source: Wayne County Airport Authority 2017 Budget Book and LeighFisher.