Chapter 5
Facility Requirements

5.0 INTRODUCTION

This chapter describes the airside and landside facility requirements necessary to accommodate existing and forecasted demand in accordance with Federal Aviation Administration (FAA) and New York State Department of Transportation (NYSDOT) design and safety standards. The facility requirements are based upon the aviation demand forecasts presented in Chapter 4, *Air Traffic Forecasts*, and the guidelines provided in FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, and 14 CFR Part 77, *Objects Affecting Navigable Airspace.* The major components of this chapter are listed below:

- Airfield Capacity Analysis
- Airfield Facility Requirements
- Terminal Facility Requirements
- Landside Facility Requirements
- Air Cargo Requirements
- General Aviation Requirements
- Support Facility Requirements

5.1 AIRFIELD CAPACITY ANALYSIS

Airfield capacity refers to the ability of an airport to safely accommodate a given level of aviation activity. In the forecast chapter, a historical view of the various aviation demands placed on the airport was presented along with a forecast of future demand throughout the planning period. The airport must be able to accommodate the projected demand by providing sufficient airside and landside facilities. If deficiencies exist in either of these two areas, they will impede the use of the airport. This, in turn, may hinder the economic potential of the airport and the communities it serves. The evaluation of airfield capacity and an airport's ability to meet projected aviation demand is accomplished through a capacity and facility requirements analysis. The FAA has prepared a number of publications to assist in the calculation of capacity. This report will use the methodologies described in AC 150/5300-13A, *Airport Design,* and AC 150/5060-5, *Airport Capacity and Delay*.

AC 150/5060-5 defines capacity as a measure of the maximum number of aircraft operations which can be accommodated at an airport. The AC provides a methodology that identifies separate levels of hourly capacity for visual flight rule (VFR) and for instrument flight rule (IFR) conditions. In addition, an annual measure of capacity is the annual service volume (ASV), which is defined as a reasonable estimate of an airport's annual maximum capacity. It is recommended that airports begin planning for additional capacity once 60 percent of the ASV is exceeded, with those improvements being constructed at the 80 percent ASV threshold.

Given the limited function and utilization, Runway 10R-28L is excluded from the capacity analysis completed in this section. In addition, with stable and conservative growth, the focus of the capacity analysis will be on forecast activity for the year 2040.

5.1.1 Factors Affecting Capacity

It is important to understand the various factors that affect the ability of an air transport system to process demand. Once these factors are identified, and their effect on the processing of demand is understood, efficiencies can be evaluated. The airfield capacity analysis will consider several factors that affect the ability of an airport to process demand. These factors include:

- Meteorological Conditions
- Runway/Taxiway Configurations
- Runway Utilization
- Aircraft Fleet Mix
- Percent Arriving Aircraft
- Percent Tough-and-Go Operations
- Exit Taxiway Locations
- Peaking Characteristics

Meteorological Conditions

Meteorological conditions specific to the location of an airport not only influence the airfield layout, but also affect the use of the runway system. As weather conditions change, airfield capacity can be reduced by low ceilings and visibility. Runway usage will shift as the wind speed and direction change, also impacting the capacity of the airfield.

To better understand the impacts of weather conditions on capacity, two types of aviation conditions must be understood. For purposes of capacity evaluation, these weather conditions are described as VFR conditions and IFR conditions. According to AC 150/5060-5, VFR conditions occur when the cloud ceiling is at least 1,000 feet above ground level (AGL) and the visibility is at least three statute miles. IFR conditions occur when the reported cloud ceiling is at least 200 feet but less than 1,000 feet and/or visibility is at least one statute mile but less than three statute miles. To determine the weather conditions at an airport, wind data collected from a weather station and complied by the National Oceanic and Atmospheric Administration (NOAA) is utilized. Based upon data collected from the reporting station located at NFIA, VFR conditions occur at the airport approximately 87.95 percent of the time, and IFR conditions occur approximately 12.05 percent of the time. Wind coverage is depicted in the windroses contained in **Figures 5-1** and **5-2**. For the purposes of this analysis, wind was assessed at 20 knots, 16 knots, 13 knots, and 10.5 knots for Runways 10L-28R and 6-24 to account for the allowable crosswind components for aircraft with a RDC of A/B-I (10.5 knots), A/B-II (13 knots), A/B-III (16 knots), C/D-I through C/D-III (16 knots), A/B-IV (20 knots), and C/D-IV through C/D-VI (20 knots). Under VFR conditions, wind coverage was also assessed for Runway 10R-28L at 10.5 knots to account for aircraft with an RDC of A/B-I.

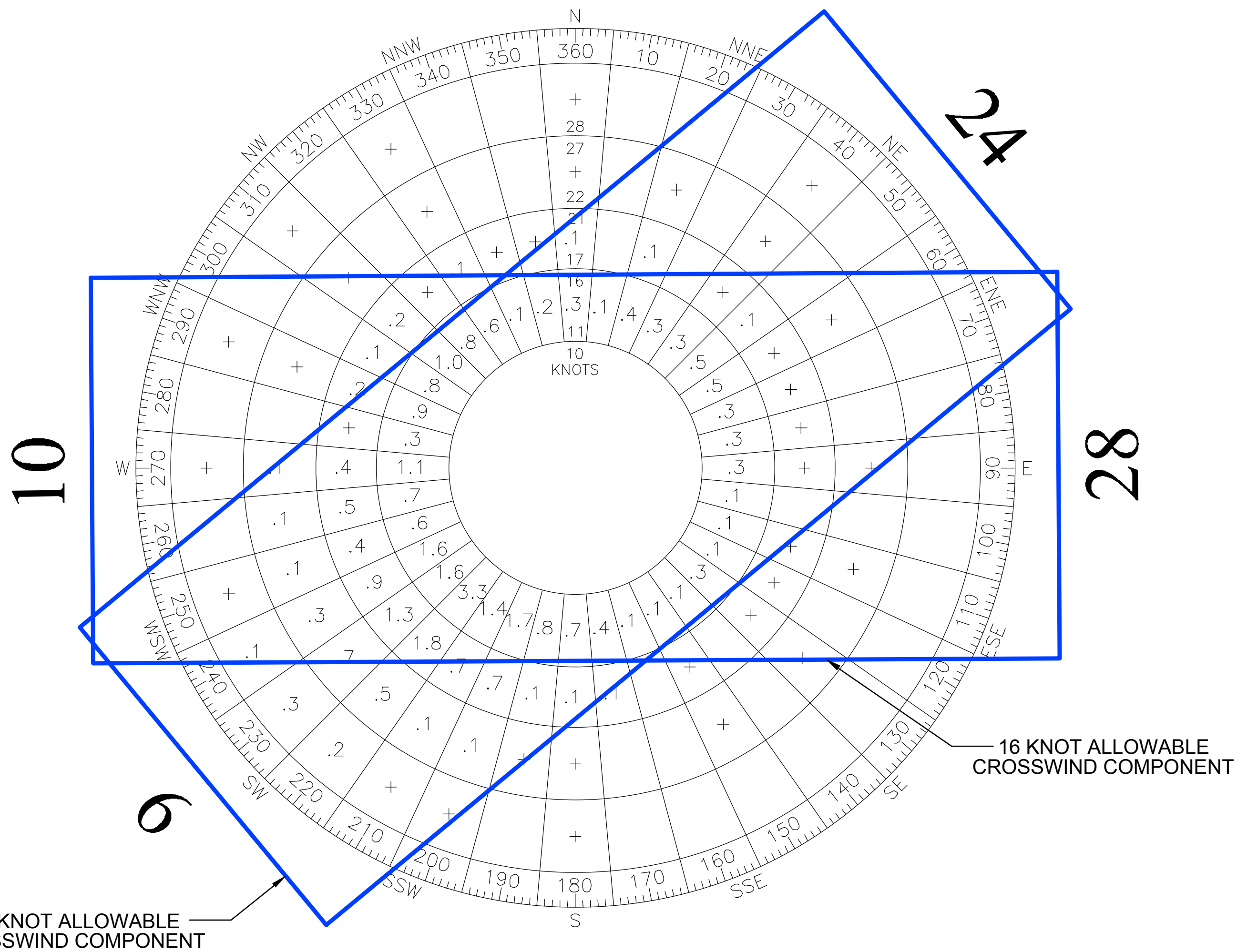
Runway/Taxiway Configurations

The configuration of the runway system refers to the number, location, and orientation of the active runway(s), the type and direction of operations, and the flight rules in effect at a particular time. For the purpose of this analysis, NFIA has two intersecting runways: primary Runway 10L-28R and crosswind Runway 6-24. Runway 10R-28L is not being considered.

ALL WEATHER WIND ROSE

FIGURE 5-1

ALL WEATHER
ALL CEILING AND VISIBILITIES



WIND ROSE

	20 KNOTS	16 KNOTS	13 KNOTS	10.5 KNOTS
COMBINED	99.98%	99.70%	98.57%	96.19%
RUNWAY 10–28	99.71%	98.32%	93.64%	87.29%
RUNWAY 6–24	99.63%	98.33%	94.81%	90.49%

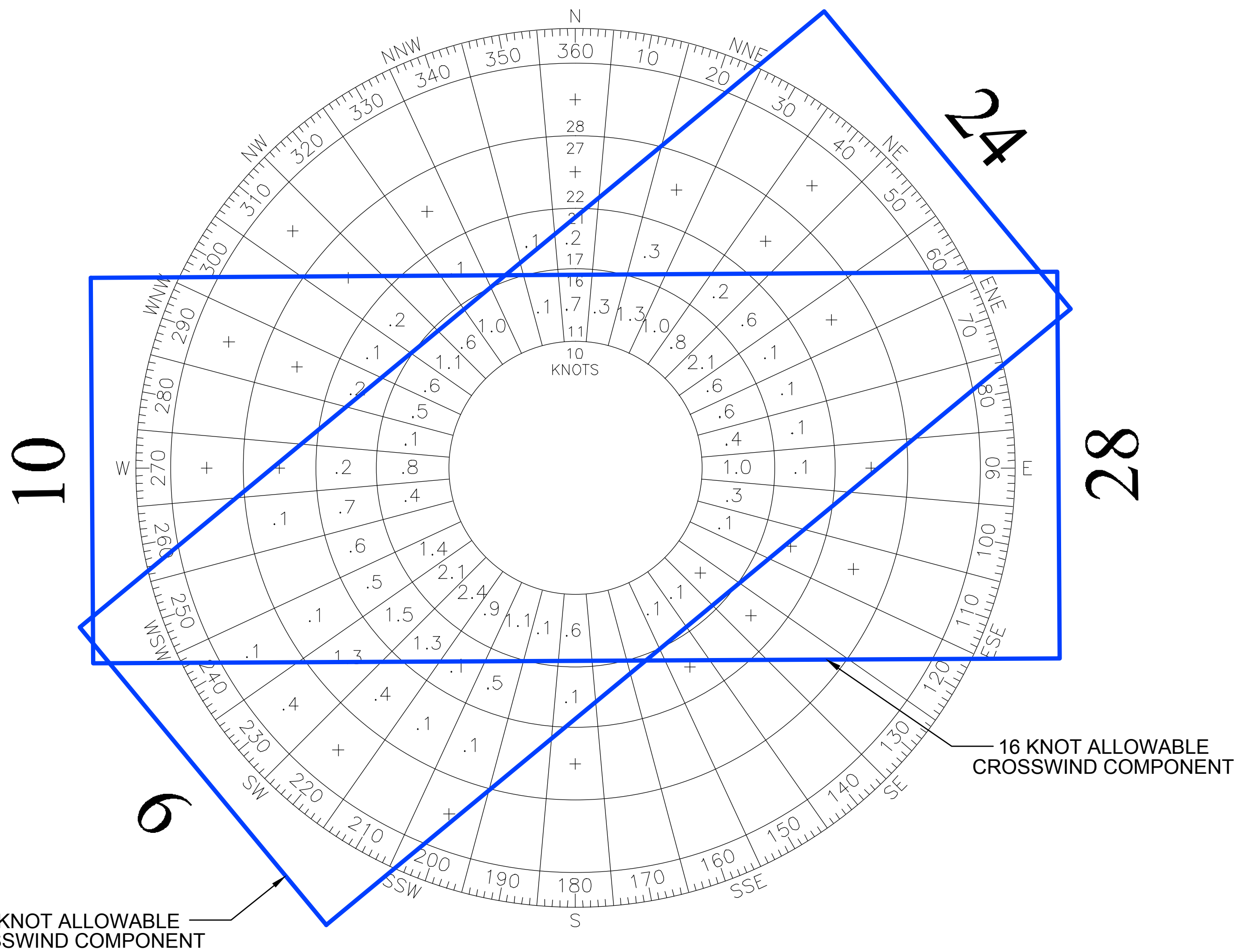
SOURCE:
NATIONAL CLIMACTIC DATA CENTER
NIAGARA FALLS AIR RESERVE BASE
1973–2015

IFR WIND ROSE

FIGURE 5-2

IFR

CEILING < 1000' AND / OR VISIBILITY < 3 MILES BUT CEILING ≥ 200' AND VISIBILITY ≥ ½ MILES



WIND ROSE

	20 KNOTS	16 KNOTS	13 KNOTS	10.5 KNOTS
COMBINED	99.94%	99.49%	97.78%	94.48%
RUNWAY 10–28	99.56%	97.81%	92.05%	84.82%
RUNWAY 6–24	99.45%	97.78%	93.80%	89.10%

SOURCE:
NATIONAL CLIMACTIC DATA CENTER
NIAGARA FALLS AIR RESERVE BASE
1973–2015

Runway Utilization

Aircraft generally desire to takeoff and land into the wind. At NFIA, winds strongly favor both Runways 24 and 28R depending on the time of the year; however, commercial service aircraft use Runway 28R due to the runway length the aircraft require. Overall, the general estimate provided by Air Traffic Control Tower (ATCT) for runway utilization is as follows:

- Runway 10L 5%
- Runway 28R 50%
- Runway 6 5%
- Runway 24 40%

Aircraft Fleet Mix

The capacity of a runway is also dependent upon the type and size of aircraft that use it. As per AC 150/5060-5, aircraft are placed into one of four classes (A through D) when conducting capacity analyses. They differ from the classes used in the determination of the Airport Approach Category (AAC). These classes are based on the amount of wake vortex created when the aircraft passes through the air. Small aircraft departing behind larger aircraft must hold longer for wake turbulence separation. The greater the separation distance required, the lower the airfield's capacity.

For the purposes of capacity analyses, Class A consists of aircraft in the small wake turbulence class - single-engine and a maximum takeoff weight of 12,500 pounds. Class B is made up of aircraft similar to Class A, but with multiple engines. Class C aircraft are in the large wake turbulence class with multiple engines and takeoff weights between 12,500 pounds and 300,000 pounds. Class D aircraft are in the heavy wake turbulence class and have multiple engines and a maximum takeoff weight greater than 300,000 pounds. Typically, Class A and B aircraft are general aviation (GA) single-engine and light twin-engine aircraft. Class C and D consist of large jet and propeller driven aircraft generally associated with larger commuter, airline, air cargo, and military use.

The aircraft fleet mix is defined by the percentage of operations conducted by each of these four classes of aircraft at NFIA. The approximate percentage of operations conducted at NFIA by each of these types of aircraft is as follows:

Aircraft Type	Percent of Operations
• Class A	20%
• Class B	19%
• Class C	60%
• Class D	1%

The mix index for an airport is calculated as the percentage of Class C aircraft operations, plus three times the percentage of Class D operations (%C + 3D). By applying this calculation to the fleet mix percentages for NFIA, a Mix Index of 63 is obtained per the following equation:

Class C Operations (60) + (3 * Class D Operations (1)) = Mix Index (63)

Percent Arriving Aircraft

The capacity of the runway is also influenced by the percentage of aircraft arriving at the airport during the peak hour. Arriving aircraft are typically given priority over departing aircraft. However, aircraft arrivals generally require more time than aircraft departures. Therefore, the higher the percentage of aircraft arrivals during peak periods of operations, the lower the annual service volume. According to airport management, operational activity at NFIA is well balanced between arrivals and departures. Therefore, it is assumed in the capacity calculations that arrivals equal departures during the peak period.

Percent Touch-and-Go Operations

A touch-and-go operation refers to an aircraft maneuver in which the aircraft performs a normal landing touchdown followed by an immediate takeoff, without stopping or taxiing clear of the runway. These operations are normally associated with flight training and are included in the local operations figures reported by the air traffic control tower (ATCT). Approximately five percent of the airport's GA operations can be attributed to touch-and-go operations. In 2012 (base year for forecasts), there were 14,825 GA operations which included approximately 548 touch-and-go operations. However, in addition to GA touch-and-go operations, it is estimated that approximately 30 percent of the military operations are touch-and-go, or practice approaches, which have a similar effect on an airport's capacity. In 2012 there were 7,846 military operations which included approximately 2,354 touch-and-go operations. Combined, it is estimated that touch-and-go operations comprise approximately 14.4 percent of the airport's total operations, and will remain at this percentage level in the future.

Exit Taxiway Locations

A final factor in analyzing the capacity of a runway system is the ability of an aircraft to exit the runway as quickly and safely as possible. The location, design, and number of exit taxiways affect the occupancy time of an aircraft on the runway system. The longer an aircraft remains on the runway, the lower the capacity of that runway.

Runway 6-24 offers a full parallel taxiway with several exits along the length of Taxiway D. While Runway 10L-28R is served by full parallel taxiway, there are few available exits for larger aircraft landing on Runway 28R, which results in a slight reduction of the airport's overall capacity. Additionally, the parallel taxiway serving Runway 28R is on the opposite site of the runway from the passenger terminal which requires back-taxiing or a runway crossing. The single south side exit for aircraft landing on Runway 28R, Taxiway K, leads to a taxiway route that has wingspan clearance issues for most Airplane Design Group (ADG) III aircraft when taxiing near the former U.S. Army facilities and the T-Hangars in the based general aviation area.

Peaking Characteristics

Peak activity estimates for commercial, military, and general aviation operations were forecast in Chapter 4, *Air Traffic Forecasts*. Airline activity at NFIA exhibits daily peaks consisting of quick (less than one hour) turns periodically throughout the day. Commercial activity is greatest during the spring months and around holidays; general aviation activity is greatest during the summer; and military operations are relatively consistent throughout the year. The level of daily operational demand is relatively constant throughout the year in respect to total airport operations (seasonal peaks do not coincide for different operational types) that would impact airfield capacity.

5.1.2 Capacity Calculations

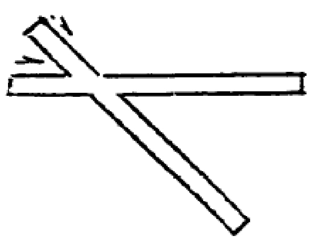
FAA AC 150/5060-5 provides guidance used to calculate airfield capacity and provide planning estimates on hourly airfield capacity under both VFR and IFR conditions, which are the theoretical maximum number of aircraft operations (takeoffs and landings) that can take place on the runway system in one hour. The various capacity elements are then consolidated into a single figure, the ASV, for the airport. The ASV is the theoretical maximum number of aircraft operations that the airport can support over the course of a year.

VFR/IFR Hourly Capacities

Because characteristics of airports vary so widely, guidance in AC 150/5060-5 is provided for different types of airports, from large commercial service hubs, to small single runway facilities. According to AC 150/5060-5, VFR and IFR capacity calculations are based on certain assumptions such as the previously calculated Mix Index. These assumptions and their relevance to NFIA are described below:

- **Runway-Use Configuration** - Any runway layout can be approximated by one of the 19 depicted runway-use configurations which are included in AC 150/5060-5. The configurations vary from single runways up through multiple parallel runways and crosswinds. For NFIA, runway configuration 9 is shown below along with the base capacity estimates. This orientation most closely resembles the conditions at NFIA.

9.



0 to 20	98	59	230,000
21 to 50	77	**57**	200,000
51 to 80	77	56	**215,000**
81 to 120	76	59	**225,000**
121 to 180	72	60	265,000

- **Percent Arrivals** – the number of arrivals and departures is relatively balanced during the peak hour.

- **Percent Touch-and-Go Operations** - The percent of touch-and-go operations is within the range in Table 2-1 of AC 150/5060-5. Between both GA and military, the percentage of touch-and-go operations at NFIA is approximately 14.4 percent of total airport operations. This number is considered high; however, it is reflective of military training operations conducted at the airport.

- **Taxiways (Exit Factor)** – While capacity is being calculated for the year 2040 activity levels, the assumption is based on the existing airfield. Based on direction from AC 150/5060-5, the exit rating used in the analysis is 0.92. Any taxiway improvements depicted in the alternatives analysis and recommended plan will only further improve overall airport capacity.

- **Runway Instrumentation** - There is an instrument landing system (ILS) approach to Runway 28R and GPS approaches to all other runway ends. NFIA has the necessary ATC facilities and services to carry out operations in a radar environment (Buffalo TRACON).

Hourly Airfield Capacity

The hourly and annual capacities of the NFIA airfield were calculated using the preceding information and the guidance presented in FAA AC 150/5060-5. Hourly capacity values were determined using the following equation:

Hourly capacity of the runway component = C * T * E

Where: C = Base Capacity (77 VFR, 56 IFR)
T = Touch-and-Go Factor (1.10 VFR, 1.0 IFR)
E = Exit Factor (0.92)

The base capacity value (C), the touch-and-go factor (T), and the exit factor (E) are derived from the hourly airfield capacity graphs contained in AC 150/5060-5*.* Using the data presented in the preceding formula and the graphs/charts contained in AC150/5060-5, it was determined the existing airfield's hourly capacity is estimated at approximately 78 operations during VFR conditions and approximately 52 operations during IFR conditions. The weighted hourly capacity (Cw) is approximately 74.8 operations.

Annual Service Volume

The ASV for NFIA was calculated using the VFR and IFR hourly capacities provided in AC 150/5060-5, *Airport Capacity and Delay*, to a weighted hourly capacity (Cw) through use of a formula that considers the relative occurrence of those two conditions. This number is then multiplied by two factors that account for airport peaking characteristics. Ratios are used to adjust for hourly peak periods during the day (H) and daily peak periods during the year (D).

This formula is illustrated below.

ASV = Cw * H * D

Where: ASV = Annual Service Volume
Cw = Weighted Hourly Capacity (74.8)
H = Ratio of Average Daily Demand to Average Peak Hour Demand (12)
D = Ratio of Annual Demand to Average Daily Demand (238)

The ASV resulting from the formula contained in AC 150/5060-5 is 213,628 annual operations. With 23,160 annual operations forecast for the year 2040, this activity level represents approximately 11 percent of the airport's total operating capacity. No capacity related constraints are anticipated over the forecast period and no capacity enhancing projects for the runways or taxiways are recommended; however, new infrastructure may be recommended on the basis of safety or efficiency.

FAA guidance recommends that planning for capacity enhancement should begin when capacity reaches the 60 percent level. Planning for additional airside capacity would begin once annual activity surpasses approximately 128,000 operations. The airport is not forecast to reach this level before 2040.

5.2 AIRFIELD FACILITY REQUIREMENTS

Airside facility requirements address the items that are directly related to the arrival and departure of aircraft, primarily runways, taxiways, and their associated safety areas. To assure that all runway and taxiway systems are correctly designed, the FAA has established criteria for use in the planning and design of airfield facilities. The selection of appropriate FAA design standards for the development of airfield facilities is based on the characteristics of the most demanding aircraft expected to use the airport, or that particular facility at the airport, on a regular basis (500 or more operations per year). Correctly identifying the future aircraft types that will use the airport is particularly important, because the design standards that are selected will establish the physical dimensions of airport facilities, including separation distances between facilities that will impact airport development for years to come. Use of appropriate standards will ensure that facilities can safely accommodate aircraft using the airport today, as well as aircraft that are projected to utilize the airport in the future.

5.2.1 Critical Design Aircraft / Runway Design Code

Airport design standards are described in AC 150/5300-13A, *Airport Design*. This document provides criteria for grouping aircraft into runway design codes (RDCs). The RDC consists of a letter representing an aircraft approach category (AAC) (based on approach speed), a number representing an airplane design group (ADG) (based on tail height and/or wingspan), and a number representing the visibility minimums associated with the runway (based on corresponding runway visual range (RVR) values in feet). These groupings are presented in **Table 5-1**.

Review of Chapter 4, *Air Traffic Forecasts*, indicates that the most demanding aircraft currently meeting the operational threshold of 500 annual operations on Runway 10L-28R is the McDonnell Douglas MD-80 series operated by Allegiant Air. Allegiant operates several models within the MD-80 series, but primarily utilizes MD-83 aircraft with a wingspan of 107.9 feet and an approach speed of 144 knots. With the current visibility minimums, the existing RDC for Runway 10L-28R is D-III-4000.

The *Air Traffic Forecasts* show that Allegiant Air will phase out the MD-80 series of aircraft and increase use of the Airbus A320 series, creating an interim RDC of C-III-4000 based on the current visibility minimums. However, the critical design aircraft at NFIA will transition over the planning period to the Boeing 767-300ER based on enhanced international service or increased cargo service. The Boeing 767-300ER has a wingspan of 156.2 feet and an approach speed of 145 knots. With the current visibility minimums, the RDC for Runway 10L-28R will transition to D-IV-4000.

When considering Runway 6-24, the most demanding aircraft with a minimum of 500 existing annual operations has been identified as the U.S. Air Force's Lockheed C-130 series, which is based at NFIA at the Niagara Falls Air Reserve Station. The C-130 has a wingspan of 132.6 feet and an approach speed of 130 knots. It is expected that the C-130 will remain the design aircraft for Runway 6-24 into the future. With the current visibility minimums, the existing and future RDC for Runway 6-24 is C-IV-5000. Should visibility minimums improve below 1 mile, as will be discussed later in this chapter, the visibility component of the RDC will change.

Table 5-1 Runway Design Code Characteristics

Aircraft Approach Category (AAC)	
Category	Approach Speed
A	Less than 91 knots
B	91 knots or more but less than 121 knots
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots
E	166 knots or more
Airplane Design Group (ADG)	
Group	Tail Height (and/or) Wingspan
I	< 20' // < 49'
II	20' - < 30' // 49' - < 79'
III	30' - < 45' // 79' - < 118'
IV	45' - < 60' // 118' - < 171'
V	60' - < 66' // 171' - < 214'
VI	66' - < 80' // 214' - < 262'
Visibility Minimums (VIS)	
RVR (FT)	Flight Visibility Category (statute mile)
VIS	Visual Approaches
5000	Not lower than 1 mile
4000	Lower than 1 mile but not lower than ¾ mile
2400	Lower than ¾ mile but not lower than ½ mile
1600	Lower than ½ mile but not lower than ¼ mile
1200	Lower than ¼ mile

Source: FAA AC 150/5300-13A, referenced September 2013

Presently, Runway 10R-28L is utilized primarily by general aviation aircraft, including some business jets and twin-engine aircraft. Information from the 2001 Airport Layout Plan Update identified the runway to serve aircraft with a current RDC of B-II-VIS. It is anticipated that the use of the runway will remain unchanged in future years, and an RDC of B-II-VIS will remain applicable, with the design aircraft represented by twin-engine turbofan aircraft such as the King Air 200 or a mid-size business jet.

Recommendation: The future RDC for Runways 10L-28R, 6-24, and 10R-28L are D-IV-4000, C-IV-5000, and B-II-VIS, respectively.

Per the requirements identified in FAA AC 150/5300-13A, not all airport facilities will be designed to accommodate the most demanding aircraft at NFIA. Certain airside and landside facilities, such as taxiways and general aviation areas that are not intended to serve certain types of aircraft, may be designed to accommodate less demanding aircraft, where necessary, to ensure cost-effective development. For example, taxiways and taxilanes designed to solely serve aircraft utilizing a general aviation area will be designed to accommodate the RDC and Taxiway Design Group (TDG) of aircraft utilizing that area, and not for larger passenger jets that will not require access to those facilities. Designation of the appropriate standards for all proposed development on the airport is shown on the Airport Layout Plan.

Airfield facility requirements are covered in this section as follows:

- Runway Orientation
- Runway Length

- Runway Width
- Runway Strength
- Runway Safety Areas
- Runway Object Free Areas
- Runway Protection Zones
- Declared Distances
- Runway Pavement Markings
- Taxiways
- Airfield Lighting
- Visual Approach Aids
- Instrument Approaches
- Airfield Facility Requirements Summary

5.2.2 Runway Orientation

A significant factor in evaluating a runway's orientation is the direction and velocity of the prevailing winds. Ideally, all aircraft takeoff and land in the direction of the wind. A runway alignment that does not allow an aircraft to go directly into the wind creates what is known as a crosswind component (i.e. winds at an angle to the runway in use), which makes it more difficult for a pilot to guide the airplane down the intended path. The commonly used measure of degree to which a runway is aligned with the prevailing wind conditions is the wind coverage percentage, which is the percent of time crosswind components are below an acceptable velocity. Essentially, this measure indicates the percentage of time aircraft within a particular design group will be able to safely use the runway. Current FAA standards recommend that airfields provide 95% wind coverage factor.

Wind data for NFIA was obtained from the National Climate Data Center via the FAA's Airports GIS website. The wind data was collected for a 10-year period from 2006 through 2015, and was compiled into All Weather and IFR Wind Roses presented in Figures 5-1 and 5-2. The wind rose shows the percentage of time winds at NFIA originated from different directions at various velocities. These percentages were then analyzed based on runway orientation and can be seen in **Table 5-2**. Ideally, the primary instrument runway at an airport should be the runway that has the highest percentage of wind coverage under IFR conditions, during which an approach procedure is needed. As noted in Table 5-1, this is not the case at NFIA, where the runway that has the highest percentage of wind coverage at 10.5 knots and 13 knots during IFR conditions is Runway 6-24 and not Runway 10-28.

According to the runway wind analysis, the current runway alignment at NFIA provides excellent coverage and meets the recommended 95% coverage in nearly all instances, with the exclusion of coverage at 10.5 knots in IFR conditions, where coverage is 94.48%. When assessing individual runways, neither Runway 10-28 or Runway 6-24 provide adequate coverage independently when considering a crosswind component of 10.5 knots or 13 knots in All-Weather or IFR conditions. As a result, the availability of a crosswind runway at NFIA is important to ensure continued use of the airport for aircraft with an RDC of A-I, A-II, B-I, or B-II.

Table 5-2 Runway Wind Coverage Analysis

	All Weather Wind Coverage				IFR Wind Coverage			
Crosswind Component (Knots)	**10.5**	**13**	**16**	**20**	**10.5**	**13**	**16**	**20**
Runway Design Code	**A-I, B-I**	**A-II, B-II**	**A-III, B-III, C-I – C-III, D-I – D-III**	**A-IV, B-IV, C-IV – C-VI, D-IV – D-VI**	**A-I, B-I**	**A-II, B-II**	**A-III, B-III, C-I – C-III, D-I – D-III**	**A-IV, B-IV, C-IV – C-VI, D-IV – D-VI**
All Runways (%)	96.19	98.57	99.70	99.98	94.48	97.78	99.49	99.94
Runway 10-28 (%)	87.29	93.64	98.32	99.71	84.82	92.05	97.81	99.56
Runway 6-24 (%)	90.49	94.81	98.33	99.63	89.10	93.80	97.78	99.45

Source: 725287 NIAGARA FALLS INTL AIRPORT ANNUALPERIOD RECORD 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015. Data compiled by McFarland Johnson, 2016.
Notes: As the orientation for the parallel Runways 10-28 is the same, the assessment of wind coverage is only conducted once and is similar for both runways.

Recommendation: No change to the orientation of runways at NFIA is recommended.

5.2.3 Runway Length

Niagara Falls International Airport's runway system consists of three runways: primary Runway 10L-28R, crosswind Runway 6-24, and parallel Runway 10R-28L. Runway 10L-28R is 9,829 feet in length and 150 feet wide. The maximum takeoff distance available (TODA) is 10,829 feet and the maximum landing distance available (LDA) is 9,829 feet. Runway 10L-28R is used for large aircraft and military operations and currently will support a dual-tandem aircraft weight of 957,000 pounds.

Runway 10L-28R at NFIA has been extended since the last Airport Layout Plan (ALP) Update was completed in 2001. Runway 10L-28R was extended to a length of 9,829 feet from its previous length of 9,125 feet. The extension was constructed to the Runway 10L end, where a 704 foot addition was built to include a 700-foot displaced threshold and a turnaround for aircraft preparing to takeoff. The extension was constructed with the intention of providing additional runway takeoff length for larger aircraft, including the KC-135 that was regularly operating at the airport at the time.

In addition, Runway 6-24 has been shifted north along centerline since the last ALP. The shift of Runway 6-24 was completed in 2011 to provide standard runway safety areas (RSAs) off the Runway 6 end. Prior to construction, the Runway 6 RSA, measuring 500 feet in width and 1,000 feet in length, did not remain entirely on airport property and encompassed portions of Porter Road and parcels across Porter Road. Construction included the addition of a 450-foot extension to the Runway 24 end, and the relocation of the Runway 6 end by 450 feet, thereby shifting the RSA by 450 feet away from Porter Road and the adjacent parcels. No additional runway length was provided as part of this construction; however, the relocation of the Runway 24 end further separated that runway end from the Runway 28R end, which previously shared the same pavement.

Previous runway length assessments at NFIA were based on older aircraft using the airport at that time, such as the KC-135. **Table 5-3** presents runway requirements for newer, more efficient aircraft currently using, and projected to use, the airport in the future, such as the Boeing 767-300ER, Boeing 757-200, Boeing 737-800, and Airbus A320. The runway lengths were calculated using the methodology specified in FAA AC 150/5325-4B, *Runway Length Requirements for*

Airport Design. The AC specifies that runway length analysis for regional jets and airplanes with a maximum takeoff weight (MTOW) of more than 60,000 pounds should be conducted using the airport planning manuals published by the manufacturers of aircraft using the airport on a "substantial use" basis (i.e., 500 annual operations). The assessment of the airport planning manuals is included as part of Appendix G.

Table 5-3 Runway Length Requirements

Aircraft	Runway Length from Manual[1]	Runway Length Hot Day[3]
A319-100	7,600	8,200
767-300ER	8,200	9,200
747-8F	10,300	10,900

Source: Aircraft Manufacturers Airport Compatibility Planning Manuals. Data compiled by McFarland Johnson, 2013.
Notes:
[1]Runway length identified as required at 59 degrees Fahrenheit at MTOW
[2]No gradient adjustment is required for aircraft utilizing Runway 10L-28R. An adjustment of 80 feet should be considered for operations on Runway 6-24
[3] The definition of "Hot Day" utilized in this assessment is the mean maximum daily temperature of 82 degrees Fahrenheit

This methodology accounts for a wide variety of factors including: airport elevation, runway gradient, aircraft takeoff and landing weights, mean maximum daily temperature, runway conditions (wet or dry), length of haul, etc. All of these factors were considered in the development of runway length requirements. However, one exception was made. The AC specifies that runway lengths should be calculated using haul lengths used on a substantial use basis. The AC further states that runway length requirements for long haul routes should be calculated using MTOW, while the requirements for short-haul routes should be calculated using actual operating takeoff weights. This analysis determines the ability of the existing runway system to accommodate aircraft currently using the airport to existing and potential future destinations, the runway length analysis was conducted using MTOW for all aircraft examined.

The aircraft presented in Table 5-2 include the most common air carrier aircraft used for passenger service, as well as aircraft that are projected to use the airport. These distances were compared to the currently available runway length for Runway 10L-28R of 9,829 feet and for Runway 6-24 of 5,188 feet. Aircraft that would likely be considered for use at NFIA by airlines currently operating there include the Airbus A320 series and the McDonnell Douglas MD-80 series. Of these aircraft, all can depart at MTOW on a "hot" day without incurring a payload or stage length penalty from Runway 10L-28R. However, none of these aircraft can use Runway 6-24 at MTOW without incurring a payload or stage length penalty.

The most distant city currently served with direct flights from NFIA is Fort Lauderdale, Florida, approximately 1,200 nautical miles from NFIA. Direct service to other hubs served by airlines now at NFIA is also possible. A destination such as Las Vegas, Nevada (an Allegiant Air destination) is approximately 2,000 nautical miles, while Phoenix-Mesa, Arizona (an Allegiant Air destination) and Dallas, Texas (a Spirit Airlines focus city) are approximately 1,900 and 1,200 nautical miles, respectively.

The airline with the most flights out of NFIA is Allegiant Air. As mentioned previously, Allegiant is already in the process of replacing their McDonnell Douglas MD-80 series aircraft with newer Airbus A320 series aircraft, which are also currently operated by Spirit Airlines at NFIA. As displayed in **Table 5-3**, runway length requirements for the Airbus A320 series are within the existing runway length. Aircraft performance for an Airbus A319 from NFIA to Las Vegas, Nevada at approximately 2,000 NM, represents the longest range domestic flight consistent with leisure-oriented service currently offered at NFIA and similar sized markets. With a high density configuration, An A319 from NFIA to Las Vegas would be near the maximum range for the aircraft and the aircraft would be operating at or near the MTOW of approximately 166,000 pounds[1]. Use of this aircraft to any east coast leisure destinations would result in a less demanding runway requirement. Takeoff performance assumptions include the aircraft being at MTOW of approximately 166,000 pounds with full passenger and baggage payload, appropriate fuel for the mission, plus required reserves and a flaps-3 setting with CFM engines. Landing performance assumes approximately 110,000 pounds in weight with slats set at 27 degrees and a flaps setting of 35 degrees.

The addition of airline service to Europe has also been considered, and the Boeing 757 and Boeing 767 are the aircraft likely to be utilized for that service. Aircraft performance for a Boeing 767-300 on transatlantic service will vary based on the end destination; however, it is assumed that any transatlantic service would be leisure/tour operator oriented and therefore passenger payload may be maximized at the expense for fuel payload for cities closer than that of the maximum potential range. As result, the analysis assumes the aircraft at 95% of the MTOW (415,000 pounds) at approximately 394,000 pounds operating from a field elevation of 592 feet. Use of this aircraft to any domestic leisure or Caribbean/Mexico destinations, would result in a less demanding runway requirement. As noted above, the takeoff field length requirement is 9,200 feet at MTOW based on the aircraft manufacturer's airport planning manual adjusted to account for the altitude and mean maximum daily temperature in Niagara Falls.

Based upon this analysis, the current length of Runway 10L-28R is adequate for the operation of most aircraft currently utilizing and projected to utilize the airport on a regular basis in the future. However, an assessment was also included regarding potential cargo service on a Boeing 747-8F. Aircraft performance for a Boeing 747-8F cargo service will vary based on the end destination and type of operation/service provided; however, given the high cost of resources such as crew and fuel, it is assumed the aircraft will need to be at or near MTOW to be economically viable. As result, the analysis assumed the aircraft at an MTOW of approximately 990,000 pounds operating from a field elevation of 592 feet. As a result, an ultimate runway length of 10,900 feet was identified.

With Regards to Runway 6-24, FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design,* indicates that for airports where each runway has a different RDC, the length of the crosswind runway should equal 100 percent of the recommended length determined for the lower crosswind capable airplanes using the primary runway. Upon review of Table 5-1, wind coverage is not provided on Runway 10L-28R at 10.5 knots or 13 knots, applicable to aircraft with an RDC of A-I, B-I, A-II, and B-II. As a result, the length of the crosswind runway, in this instance Runway 6-24, shall equal the recommended runway length for the classifications of aircraft where the crosswind component is not met on the primary runway. FAA Advisory Circular 150/5325-4B includes a multi-step process for determining recommended runway lengths. The steps were as follows:

1. Identify the lower crosswind capable airplanes using the primary runway that presently make, or will make, substantial use (a minimum of 500 operations per year) of the runway. Upon review of itinerant airport operations (as reported through the FAA Traffic Flow Management System) in 2015, a group of aircraft with an RDC of B-II were identified as

[1] A319/A319neo Aircraft Characteristics Airport and Maintenance Planning Manual (as revised May 2014), Section 2-1-1.

substantial users of the airport. These aircraft types include members of the Cessna Citation family (C25A, C550, C560, C680) and the Hawker 800.

2. Use Table 1-1 of AC 150/5325-4B, *Airplane Weight Categorization for Runway Length Requirements*, combined with the information identified in Step 1 (above) to determine the method for establishing the recommended runway length.

3. Select the recommended runway length from among the various runway lengths generated by Step 2 (above) per the process identified in the appropriate chapter of AC 150/5325-4B. In this instance, the runway length curves provided in Chapter 3, *Runway Lengths for Airplanes Within a Maximum Certificated Takeoff Weight of More Than 12,500 Pounds up to and Including 60,000 Pounds,* were utilized.

   Within Chapter 3 of the AC, Tables 3-1 and 3-2 and Figures 3-1 and 3-2 were consulted and reviewed. Operations by aircraft within Table 3-1, *Airplanes that Make Up 75 Percent of the Fleet* and Table 3-2, *Remaining 25 Percent of Airplanes that Make Up 100 Percent of Fleet*, currently occur and are anticipated to continue and grow into the future. However, it was deemed appropriate that the aircraft identified in Table 3-1 would be utilized for runway length considerations for Runway 6-24. As a result, Figure 3-1, *75 Percent of Fleet at 60 or 90 Percent Useful Load*, was consulted. It was determined that at the airport's elevation of 593 feet mean sea level (MSL) and a mean daily maximum temperature of 82 degrees Fahrenheit that a runway length of 6,250 feet is recommended to accommodate 75 percent of the fleet at 90 percent useful load. The assessment of Figure 3-1 is included within Appendix G.

4. The runway length of 6,250 feet found to be necessary in Step 3 is based on no wind, a dry runway surface, and zero effective runway gradient. As noted in the AC, adjustments should be made to account for takeoff operations when the effective runway gradient is other than zero and for landing operations of turbo-jet powered airplanes under wet and slippery conditions.

   To determine the adjustment for effective runway gradient, the runway length obtained from Figure 3-1 is increased at a rate of 10 feet for each foot of elevation difference between the high and low points of the runway centerline. At NFIA, the elevation of the high point of the runway is 592.5 feet. The elevation of the low point of the runway is 583.6 feet. As a result, the difference in elevation between the high and low points is approximately 8.9 feet, resulting in an 89-foot adjustment to the runway length, with a runway length measuring 6,339 feet.

   In addition, an adjustment for wet and slippery runways is also considered. Unlike the effective runway gradient adjustment (for takeoff operations only), this adjustment applies to landing operations and is only applicable to turbojet operations (including those completed by aircraft identified in Step 1). As a result, the increases are not cumulative and the highest adjusted runway length is considered the recommended length. As noted in the AC, the runway length for turbojet-powered airplanes obtained from the 90 percent useful load curves are increased by 15 percent or up to 7,000 feet, whichever is less. The addition of a 15% adjustment to the identified runway length of 6,250 feet leads to an adjusted length of 7,188 feet. This adjustment is reduced to the maximum allowable adjusted length of 7,000 feet for Runway 6-24.

The third runway at NFIA is Runway 10R-28L, which is 3,973 feet long. Due to the limited number of operations annually at NFIA, and particularly on Runway 10R-28L, the number of opportunities for simultaneous same-direction operations would be minimal as the airport has sufficient capacity, as detailed later in this section. During interviews with airport management and airport users, a low number of operations were identified on Runway 10R-28L with most operations on the runway occurring due to the convenience of the runway and its proximity to the general aviation facilities at NFIA. Those interviewed noted that operations on Runway 10R-28L are below those on the other runways with instrument approach procedures. When comparing Runway 10R-28L with the facilities available on Runway 10L-28R, and considering the number of annual operations at NFIA is forecast to reach a peak of 23,160 by 2040 (averaging approximately 60 operations per day) and the overall capacity of the airport as noted previously in this section, the need to maintain the third runway should be taken into account. Keeping in mind the current capacity of NFIA, the utility of Runway 10R-28L is reduced as the runway does not provide operational or safety improvements as an alternative to Runway 10L-28R. Further, with several development constraints and additional requirements for other runways, taxiways, and facilities at NFIA, the continued use of Runway 10R-28L should be reviewed as part of Chapter 6, *Alternatives Analysis*.

Recommendation: Extend Runway 6-24 to 7,000 feet.

5.2.4 Runway Width

Both Runway 10L-28R and Runway 6-24 at NFIA are 150 feet wide. Runway 10R-28L has a width of 75 feet with 60 feet of paved shoulders on each side. The widths of Runway 10L-28R and Runway 6-24 are consistent with the FAA standard for runways serving aircraft in ADGs IV and V, including the Lockheed C-130, Boeing 757, Boeing 767, and Boeing 777. The width of Runway 10R-28L is consistent with the FAA standard for a runway serving aircraft with an RDC of A-II or B-II, which includes several large twin-engine aircraft, including the King Air 200, as well as many types of business jets, including members of the Cessna Citation series. The existing width of all runways is adequate to serve existing and projected aircraft operations through 2032 and no changes are recommended.

Recommendation: No changes are recommended for runway widths at NFIA.

5.2.5 Runway Strength

Pavement strength requirements are related to three primary factors:

- weight of aircraft anticipated to use the airport,
- landing gear type and geometry, and
- volume of aircraft operations.

Airport pavement design, however, is not predicated on a particular weight that is not to be exceeded. The current pavement could safely handle much heavier aircraft on most days, but repeated use would result in premature pavement failure. Pavement design is based on the mix of aircraft that are expected to use the runway over the anticipated life of the pavement, which is usually twenty years. The methodology used to develop the runway pavement design considers the number of operations by both large and small aircraft, and reduces this data to a number of “equivalent annual operations” by a design aircraft, which is the most demanding in terms of pavement loading expected to use the airport. This may or may not be the design aircraft for planning purposes and its selection considers the type of landing gear, tire pressure, and weight. The outcome of the design process is a recommended pavement section that will accommodate operations by the forecast fleet mix, and withstand weather stresses without premature failure of the pavement.

According to the Airport's FAA 5010 Form *Airport Master Record*, Runway 10L-28R has pavement strengths of 120,000 pounds single-wheel loading, 240,000 pounds dual-wheel loading, 447,000 pounds dual-tandem-wheel loading, and 957,000 pounds double-dual-tandem-wheel loading. Runway 10L-28R is reported in good condition. These strengths are also sufficient to accommodate all existing and future aircraft projected to regularly operate on this runway, such as air carrier aircraft (Airbus A320 and the Boeing 757), military equipment (C-130), and other aircraft types that frequently utilize the airport.

Runway 6-24 has pavement strengths of 120,000 pounds single-wheel loading, 250,000 pounds dual-wheel loading, and 462,000 pounds dual-tandem-wheel loading and is listed in good condition. These strengths are sufficient to accommodate all existing operations on this runway. Should an extension of the runway occur, as recommended, it is anticipated that the use of the runway by air carrier aircraft, including the Airbus A320 series, at up to 165,000 pounds dual-wheel, could increase. The existing strength is deemed sufficient.

Runway 10R-28L has pavement strengths of 73,000 single-wheel loading and 97,000 dual-wheel loading, which is sufficient for small general aviation aircraft only, which are currently the primary users of the runway. Runway 10R-28L is listed in good condition. If future consideration of Runway 10R-28L includes its use as a taxiway, the strength of this pavement should be increased to accommodate operations by the aircraft types that will be taxiing to Runway 10L-28R, including the Boeing 767.

In addition to this analysis, as part of the Master Plan Update, a complete and detailed Pavement Management Study is currently underway. The results of the Pavement Management Study will be included as Appendix A to the Master Plan Update, and its results will be considered during the development of the Recommended Plan.

Recommendation: Evaluate the strength of Runway 10R-28L if it is converted to a taxiway.

5.2.6 Runway Safety Areas

Runway safety areas (RSAs) are defined by the FAA as surfaces surrounding a runway that are prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. RSAs consist of a relatively flat graded area free of objects and vegetation that could damage aircraft. According to FAA guidance, the RSA should be capable, under dry conditions, of supporting aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

The FAA design standard for RSAs surrounding runways serving A/B-IV and C-I through D-VI aircraft is a width of 500 feet, a length that extends 600 feet prior to the landing threshold, and a length that extends 1,000 feet beyond the runway end. Runway 10L-28R meets this design standard as a result of the implementation of declared distances in conjunction with the previous extension to the Runway 10L end, along with the addition of a displaced threshold. The RSAs surrounding Runway 6-24 currently meet this design standard after the recent completion of the Runway 6-24 shift. If Runway 6-24 is further extended, as recommended previously, displaced thresholds and declared distances may be required to ensure the RSAs remain entirely on airport property.

For runways with a RDC of A-II or B-II with visual approaches, the RSA surrounding the runway has a width of 150 feet and a length that extends 300 feet prior to the landing threshold and beyond the runway end. The RSA for Runway 10R-28L meets the requirements for existing and future aircraft use and no changes are recommended.

Recommendation: Utilize displaced thresholds and declared distances for the RSAs to Runway 6-24, as necessary should an extension to Runway 6-24 occur.

5.2.7 Runway Object Free Areas

In addition to the RSA, a runway object free area (ROFA) is also defined around runways in order to enhance the safety of aircraft operations. The FAA defines ROFAs as an area cleared of all objects except those that are related to navigational aids and aircraft ground maneuvering. However, unlike the runway safety area, there is no requirement to support an aircraft or emergency response vehicles.

The ROFA dimensions for runways serving A/B-IV and C-I through D-VI aircraft are a width of 800 feet, 600 feet prior to the landing threshold, and 1,000 feet beyond the departure end. These dimensions are applicable to Runway 10L-28R and Runway 6-24. The existing ROFAs on these runways meet FAA design standards through the implementation of declared distances and the use of displaced thresholds. A Modification of Standards (MOS) previously existed for Runway 6-24 ROFA due to the presence of the airport maintenance and snow removal equipment (SRE) building and associated fence within the ROFA. However, with the recent shift of Runway 6-24, and the implementation of declared distances, those facilities are no longer within the ROFA. If the dimensions of Runway 6-24 change in the future, declared distances will need to be utilized to ensure the ROFA remains clear of objects and on airport property.

For Runway 10R-28L, ROFA dimensions for runways serving A-II and B-II aircraft with approach visibility minimums not lower than ¾ mile are 300 feet beyond the departure end and prior to the threshold and a width of 500 feet. The ROFA for Runway 10R-28L for existing and future operations remains entirely on airport property and clear of objects.

Recommendation: No changes are recommended for ROFAs at the airport.

5.2.8 Runway Protection Zones

RPZs are trapezoidal areas on the ground off each runway end that are within aircraft approach and departure paths. The RPZ begins 200 feet beyond the end of the runway. The dimensions of the RPZ for each runway end depend on the type of aircraft and the approach visibility minimums associated with operations on that runway.

The RPZ is intended to enhance the protection of people and property on the ground. Certain land uses (i.e. residential, places of public assembly, fuel storage) are prohibited by FAA guidelines within these areas; however, they are only enforceable if the RPZ is owned or controlled by the airport sponsor. As such, airport control of these areas is strongly recommended and is primarily achieved through airport property acquisition, but can also occur through easements or zoning to control development and land use activities. The RPZ beyond the Runway 10R end is owned by the airport, but only portions of the other five RPZs are within the airport property boundary or under easement control.

The existing visibility minimums for the Runway 28R end are not lower than ¾-mile, however, the future visibility minimums for Runway 28R are proposed to drop lower than ¾-mile, which will result in an increase in the dimensions of the RPZ, as shown in **Table 5-4**. For both ends of Runway 6-24, the current visibility minimums are not lower than one mile. However, for planning purposes, **Table 5-4** will consider the lowest authorized minimums for the GPS approaches without the installation of approach lighting to Runway 6, ¾ mile, and the lowest authorized minimums for GPS for the GPS approaches with the installation of a MALSR to Runway 24, ½ mile. To acquire control of land uses within the RPZ through property acquisition or the acquisition of easements, NFIA should purchase the interest in the remaining segments of each RPZ. It is recommended that the sponsor acquire an interest in all existing RPZ areas not currently under airport control. In addition, as a result of the proposed improvements to the approach procedures at NFIA, it is recommended that the sponsor also acquire interest, through fee simple acquisition or avigation easements, in future RPZs to ensure compliance at the time improved approach procedures are developed and published.

Table 5-4 RPZ Dimensions

RPZ	Runway 10L		Runway 28R		Runway 6	
Dimension	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
Length	1,700	1,700	1,700	2,500	1,700	1,700
Inner Width	500	1,000	1,000	1,000	500	1,000
Outer Width	1,010	1,510	1,510	1,750	1,010	1,510
Acres	29.465	48.978	49.978	78.914	29.465	48.978
RPZ	**Runway 10R**		**Runway 28L**		**Runway 24**	
Dimension	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
Length	1,000	1,000	1,000	1,000	1,700	2,500
Inner Width	500	500	500	500	500	1,000
Outer Width	700	700	700	700	1,010	1,750
Acres	13.770	13.770	13.770	13.770	29.465	78.914

Sources: FAA Advisory Circular 150/5300-13A, McFarland Johnson Analysis

Recommendation: The proposed RPZ dimensions for Runways 6, 10L, 24, and Runway 28R should be acquired in fee simple or avigation easement to ensure compliance.

5.2.9 Declared Distances

Declared distances is a process whereby an airport owner declares only a certain portion of a runway as being available for takeoff or landing to meet RSA, ROFA, or RPZ requirements in a constrained environment. Consequently, this usually results in a portion of the runway not being used for takeoff or landing calculations. Declared distances include the distances the airport owner declares available for an airplane's takeoff run (TORA), takeoff distance (TODA), accelerate-stop distance (ASDA), and landing distance (LDA) requirements.

In order to provide RSAs that comply with FAA design standards while maximizing runway lengths, declared distances were implemented at NFIA. The declared distances for Runway 6-24 and Runway 10L-28R are presented in **Table 5-5**. Opportunities to amend the declared distances for Runways 24, 10L, and 28R, and the potential to implement declared distances for

Runway 6 as a result of an extension will be explored in greater detail as part of the Alternatives Analysis chapter.

Recommendations: Declared distances will be addressed in Chapter 6, *Alternatives.*

Table 5-5 Declared Distances

Runway	TODA	TORA	ASDA	LDA
6	5,188	5,188	5,188	5,188
24	5,188	5,188	5,108	5,108
10L	10,829	9,829	9,829	9,129
28R	10,529	9,829	9,129	9,129
10R	3,973	3,973	3,973	3,973
28L	3,973	3,973	3,973	3,973

Source: FAA Form 5010 Airport Master Record, September 2013.

5.2.10 Runway Pavement Markings

Both ends of primary Runway 10L-28R have precision instrument runway markings while both ends of Runway 6-24 have non-precision instrument approach markings. Runway 10R-28L is marked for visual approaches. As a result of the location of the intersection of Runways 10L-28R and 6-24, the runway markings for Runway 28R are located on the intersection between Runways 6-24 and 10L-28R. These markings meet FAA design standards and are appropriate for the current and projected instrument approach capability on each runway.

In addition, a modification of standards was received in 1996 for the inclusion of runway assault landing zone marking on Runway 6-24 for use by military aircraft at the airport. Based on discussions with airport management and military officials, it is recommended that those markings remain in place.

Recommendation: Maintain standard markings with inclusion of runway assault landing zone markings on Runway 6-24 as necessary into the future.

5.2.11 Taxiways

There are currently 12 taxiways at NFIA. Runways 10L-28R and 6-24 are served by parallel taxiways. Taxiway A, the parallel taxiway to Runway 10L-28R, and its associated stub taxiways (A1, A2, and A3) are on property owned by the U.S. Air Force and require prior permission before use. In addition, those taxiways are considered non-movement areas. Planning standards for taxiways include taxiway width, taxiway safety areas, taxiway object free areas, taxiway shoulders, taxiway gradient, and for parallel taxiways, the distance between the runway and taxiway centerlines. The dimensions of each standard vary based on the identified ADG and taxiway design group (TDG) for each taxiway. The ADG is based on the wingspan and tail height of an aircraft, while the TDG is based on the distance between an aircraft's cockpit to main gear and main gear width. There are six ADG groups, and seven TDG groups. Details regarding the various dimensions follow in **Tables 5-6 and 5-7.**

Table 5-6 Taxiway Requirements – Airplane Design Group

Design Standard	ADG I	ADG II	ADG III	ADG IV	ADG V	ADG VI
Taxiway Safety Area	49	79	118	171	214	262
Taxiway Object Free Area	89	131	186	259	320	386
Runway/Taxiway Separation	225 – 400*	240 – 400*	300-400*	400	400	500*

Source: FAA Advisory Circular 150/5300-13A.
** - Runway/Taxiway Separation vary based on approach visibility minimums*

Table 5-7 Taxiway Requirements – Taxiway Design Group

Design Standard	TDG-1	TDG-2	TDG-3	TDG-4	TDG- 5	TDG-6	TDG-7
Taxiway Width	25	35	50	50	75	75	82
Taxiway Shoulder Width	10	10	20	20	25	35	40

Source: FAA Advisory Circular 150/5300-13A.

As discussed in Chapter 2, most taxiways serving Runways 6-24 and 10L-28R are 75 feet wide. A portion of Taxiway C providing access to the Runway 10R end is 50 feet wide and a portion of Taxiway J west of the Runway 6 end is 40 feet wide. All taxiways serving aircraft accessing Runway 10L-28R, anticipated to include aircraft in TDG-5 and TDG-6, should have a width of 75 feet and a runway/taxiway separation of 400'. All taxiways serving aircraft accessing Runway 6-24, anticipated to include aircraft in TDG-3, should have a minimum width of 50 feet and a runway/taxiway separation of 400'. The current separation of 395', five feet less than the recommendation. It is also recommended that the western portion of Taxiway J, from Taxiway C to the Runway 6 threshold, be widened from 40 feet to 50 feet. All other taxiways at NFIA are adequately sized with the appropriate taxiway width, safety area, object free area, and runway-taxiway separation. None of the existing taxiways at NFIA have paved shoulders, which are required for taxiways that are utilized by ADG IV or larger aircraft, and recommended for taxiways utilized by ADG III aircraft. It is recommended that future taxiway improvements include the addition of paved shoulders of 20 feet for taxiways utilized for access to Runways 6-24 (TDG-3) and 30 feet for taxiways utilized for access to Runway 10L-28R (TDG-5 & TDG-6).

While the existing taxiways, safety areas, and separations meet or exceed standards, there are several concerns regarding the taxiway system at NFIA as they relate to the number of times an aircraft may need to cross or taxi on a runway. Some taxiing routes for aircraft at NFIA are complex. To reach the Runway 10L threshold from the terminal apron, aircraft are required to use Taxiway C to Taxiway K, and then back-taxi west on Runway 10L-28R to Taxiway A1 to access the parallel taxiway (Taxiway A) for access to Runway 10L. Conversely, aircraft landing on Runway 10L have to taxi on Runway 10L-28R to Taxiway D1 to access the terminal area or general aviation areas. The need to taxi on Runway 10L-28R for nearly all aircraft landing on the runway and for all aircraft taking off from the Runway 10L end is a safety concern and improving access to both ends of Runway 10L-28R from the terminal apron and West Ramp areas should be a priority for NFIA. Improvements could include construction of a full parallel taxiway to the south of Runway 10L-28R or converting the current Runway 10R-28L into a partial parallel taxiway, and extending it to complete a full parallel taxiway. The construction of a parallel taxiway to the south of Runway 10L-28R would also eliminate the need for commercial and general aviation aircraft to cross Runway 10L-28R to access Taxiway A (when permission is granted by the U.S. Air Force) and would only require use of runway pavement for takeoff and landing.

Additionally, improved access from Taxiway A to the Runway 24 end is also recommended. At present, military aircraft taxiing on Taxiway A are required to taxi east on Runway 10L-28R, across

Runway 6-24, before taxiing north on Taxiway D to the Runway 24 end for takeoff. Additionally, military aircraft landing on Runway 6 are also required to taxi on a portion of Runway 10L-28R prior to accessing Taxiway A3. The extension of Taxiway A to provide access to the Runway 24 end should be considered to eliminate the need to back-taxi on Runway 10L-28R and improve safety for all aircraft utilizing the airport.

There are several former runways and taxiways at NFIA that are closed to aircraft traffic. These areas, while marked as closed, continue to connect with active runways and taxiways and could cause confusion for pilots. If these surfaces are not rehabilitated to provide use to aircraft, such as the former taxiway connecting Taxiway K to Taxiway A1, the pavement should be removed to eliminate the potential for confusion. At a minimum, the pavement should be removed within the runway and taxiway safety areas for active pavements in order to prevent the use of these surfaces by aircraft taxiing to and from the runways.

As taxiways are constructed or rehabilitated, design should carefully consider the recently updated guidance for taxiway design as published in FAA AC 150/5300-13A, *Airport Design*. The new requirements include the design of taxiways for “cockpit over centerline” taxiing as opposed to “judgmental oversteering.” This change particularly impacts curves and intersections, which will require changes to accommodate the “cockpit over centerline” taxiing. The dimensions of intersection fillets and taxiway curves are based on the associated TDG for each taxiway.

Other requirements and recommendations include avoiding wide expanses of pavement, limiting runway crossings, increasing pilot situational awareness (including the elimination of taxiways direct from aprons and those taxiways that cross a parallel taxiway), and the elimination of dual purpose pavements. At NFIA, this includes elimination (pavement removal or repurposing as a runway extension) of the aligned taxiway at the approach end of Runway 24. The “Y-shaped” intersection between Taxiway C and Taxiway D at the Runway 6 end should also be addressed to reduce the potential for pilot confusion.

Potential improvements to the taxiway system, including providing improved access to all runway ends and reducing the need to taxi on or across runways several times, will be examined as part of the alternatives analysis.

Recommendation: Taxiway A2 should be widened to 75 feet. All taxiways serving aircraft bound for Runway 6-24 should have 20-foot paved shoulders, with 30-foot paved shoulders for taxiways serving aircraft utilizing Runway 10L-28R. Taxiway J should be widened to 50 feet. Other recommendations include:

- Improve access to both ends of Runway 10L-28R from terminal apron/west ramp areas
- Extend Taxiway A to provide access to the Runway 24 end
- Remove closed taxiway pavements to eliminate pilot confusion and increase safety
- Convert excess pavement beyond Runway end 6 to additional runway length
- Assess Runway 6-24 Runway/Taxiway Separation (currently 395’ with a standard of 400’)
- Reconfigure “Y-shaped” intersection of Taxiways C and D at the Runway 6 threshold

5.2.12 Airfield Lighting

Approach Lighting

Approach lighting is currently installed on the Runway 28R approach. Runway 28R has a Medium Intensity Approach Lighting System with Sequenced Flashing Lights (MALSR). The approach lighting system is designed for ILS Category (CAT) I approaches and meets existing needs at NFIA. Future needs for the Airport should consider the improvement of the ILS approach from CAT I to an Enhanced CAT I, which would enable continued use of the MALSR.

FAA AC 150/5300-13A notes that approach lights are recommended but not required for the development of procedures with visibility minimums of less than one mile, but not less than ¾ mile. The installation of a full approach light system, such as a MALSR, Approach Lighting System with Sequence Flashing Lights (ALSF), or a Simplified Short Approach Lighting System with Runway Alignment Indicator Lights (SSALR) is required for approach minimums of less than ¾ mile. NFIA should pursue non-precision approach procedures with vertical guidance where minimum visibility is as low as ½ mile that will require further installation of a MALSR approach lighting system. On Runway 10R-28L, where no instrument approach procedures are available, REILs have been installed on both runway ends. No additional approach lighting systems are recommended for Runway 10R-28L.

Recommendation: Install MALSR on Runway 24 for precision approach; install REILs to Runway 10L.

Runway Lighting

Runway 10L-28R currently has High Intensity Runway Edge Lights (HIRL). This lighting meets FAA design standards for runways supporting precision instrument approaches with a runway visual range (RVR) of no less than 1,800 feet. Runway 6-24 currently has Medium Intensity Runway Edge Lights (MIRL), which meets FAA standards for runways with non-precision approaches where RVR-based minimums are not utilized. The existing runway edge lighting system on Runway 6-24 will meet all requirements for existing and future aircraft operations at NFIA. Runway 10R-28L has MIRL, which meets FAA standards for runways with non-precision approaches where RVR-based minimums are not utilized.

Recommendation: No changes are recommended for runway lighting at NFIA.

Taxiway Lighting

All taxiways at NFIA currently have Medium Intensity Taxiway Lights (MITL) to support night and low-visibility operations. This lighting is sufficient to meet existing and future operational requirements.

Recommendation: No changes are recommended for taxiway lighting at NFIA.

5.2.13 Visual Approach Aids

Presently, Runway 10L has a four-box Visual Approach Slope Indicator (VASI) and Runway 28R was recently equipped with a PAPI. As replacement of the existing VASI becomes necessary, the installation of a more commonly utilized Precision Approach Path Indicator (PAPI) should be considered. Both ends of Runway 6-24 currently have four-light PAPIs that provide adequate vertical guidance in the future. Similarly, both ends of Runway 10R-28L have two-light PAPIs which will provide adequate vertical guidance in the future. No additional visual aids are recommended for Runways 6-24 or 10R-28L.

Recommendation: Replace the existing VASI on Runway 10L with a PAPI.

5.2.14 Instrument Approaches

There are several straight-in instrument approaches published for Runways 6, 10L, 24, and 28R at NFIA. The types of approaches, along with the decision height or minimum descent altitude and the minimum visibility, are further detailed in **Table 5-8**.

Table 5-8 Instrument Approach Procedures

Runway End	Approach Type	Decision Altitude above Threshold or Minimum Descent Altitude	Minimum Visibility
Runway 28R	ILS/LOC	250 Feet	4,000 Feet
Runway 28R	ILS/LOC/DME	250 Feet	4.000 Feet
Runway 28R	RNAV (LPV)	250 Feet	4,000 Feet
Runway 28R	TACAN	412 Feet	4,000 Feet
Runway 28R	NDB	612 Feet	4,000 Feet / 1 3/8 Mile*
Runway 10L	RNAV (LP)	392 Feet	1 Mile / 1 1/8 Mile*
Runway 6	RNAV (LPV)	278 Feet	1 Mile
Runway 24	RNAV (LP)	588 Feet	1 Mile / 1 ¾ Mile*
Runway 24	RNAV (LP)	408 Feet	1 Mile / 1 1/8 Mile*

Source: FAA Approach Plates – September 2016
** - Minimum Visibility is different between A & B type aircraft and C & D type aircraft*

To support the existing precision approaches, Runway 28R is equipped with a 1,400 foot long MALSR, along with a lighted touchdown point and runway visual range (RVR) equipment at touchdown. The ILS and localizer (LOC) approaches on Runway 28R are adequate to meet existing needs. The ILS on Runway 28R should, however, be considered for an update to CAT I Enhanced standards which would reduce approach minimums to a decision height as low as 200 feet and an RVR as low as 1,800 feet. This approach would not require replacement of the MALSR, would utilize the touchdown zone lights and runway centerline lights, and would improve visibility minimums 0.37% of the time.

In addition to the ILS and Localizer Performance with Vertical Guidance (LPV) instrument approaches for Runway 28R, several other approaches have been published including a Non-Directional Beacon (NDB) and a Tactical Air Navigation System (TACAN) which is primarily utilized by military aircraft and is maintained by the U.S. Air Force.

Runway 10L has one GPS approach, a Localizer Performance (LP). In the immediate future, no additional ground based electronic navigation aids are recommended for Runway 10L. However, a precision approach for Runway 10L, in the form of an LPV procedure with minimums of ½ mile, is recommended within the planning period. This will provide vertically guided approaches to both ends of Runway 10L and 28R and will provide improved access to the airport during conditions of limited visibility. Development of a precision approach to Runway 10L would require continued coordination due to the airspace concerns complicated by the restricted area over Niagara Falls State Park and the nearby Canadian Airspace.

As noted, Runways 6 and 24 have several LP and LPV approaches published. Runway 6 has an LPV approach with a decision altitude of 278 feet above threshold height and a minimum visibility of one mile. The best approach for Runway 24 is an LP with a minimum descent altitude of 408 feet Height Above Threshold (HATh) and a minimum visibility of one mile for category A and B type aircraft and 1 1/8 mile for category C and D type aircraft. As noted previously in this chapter, FAA design standards permit a minimum visibility of ¾ mile for LPV approaches on runways without approach lighting. With the favorable wind conditions on Runway 24, the Airport should pursue the improved approach for Runway 24, and reduced minimums for approaches to both ends.

Recommendation: The ILS to Runway 28R should be upgraded to CAT I Enhanced standards. Upgrade the Runway 24 LP approach to an LPV in order to achieve reduced minimums.

5.2.15 Airfield Facility Requirements Summary

Table 5-9 summarizes the current condition, design standard, and the recommended design of the primary airside elements discussed above.

5.3 TERMINAL FACILITY REQUIREMENTS

5.3.1 Basis of Analysis

This section summarizes general planning factors and assumptions used to analyze facility requirements for key functional areas of the passenger terminal. Requirements were analyzed based on a multitude of factors. The primary tool for the analysis was *ACRP Report 25, Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide* (Model). However, Airport staff input was carefully considered, in addition to industry-wide trends, facilities provided at comparable airports, and guidelines published in the following publications: International Air Transport Association's (IATA's) *Airport Development Reference Manual*; FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*; and FAA AC 150/5300-13A, *Airport Design*. Requirements were generated for aircraft gates/parking positions, holdrooms, ticketing and check-in positions, passenger security screening, baggage handling facilities, and Federal Inspection Service (FIS) screening facilities. Additional consideration was given to other terminal requirements including airline operational space, public circulation, both secure and non-secure, concessions, administration space, and terminal support space.

Table 5-9 Airside Facility Requirements Summary

Item / Facility	Existing Facility or Capacity	Ultimate Requirement	Deficit
RUNWAYS			
Runway 10L-28R Length	9,829 feet	9,829 feet	0 feet
Runway 10L-28R Width	150 feet	150 feet	0 feet
Runway 6-24 Length	5,188 feet	7,000 feet	1,812 feet
Runway 6-24 Width	150 feet	150 feet	0 feet
Runway 10R-28L Length	3,973 feet	3,973 feet*	0 feet
Runway 10R-28L Width	75 feet	75 feet*	0 feet
PARALLEL TAXIWAYS			
Taxiway A Offset	800 feet	400 feet	0 feet
Taxiway A Width	75 feet	75 feet	0 feet
Taxiway D Offset	395 feet	400 feet	5 feet
Taxiway D Width	75 feet	75 feet	0 feet
LIGHTING & NAVAIDS			
Runway 10L	HIRL, VASI, Centerline Lights	HIRL, PAPI, REIL, Centerline Lights	PAPI, REIL
Runway 28R	HIRL, MALSR, Touchdown Zone Lights, Centerline Lights	HIRL, MALSR, Touchdown Zone Lights, Centerline Lights	None
Runway 6	MIRL, PAPI, REIL	MIRL, PAPI, REIL	None
Runway 24	MIRL, PAPI, REIL	MIRL, PAPI, REIL, MALSR	MALSR
Runway 10R	PAPI, REIL	PAPI, REIL	None
Runway 28L	PAPI, REIL	PAPI, REIL	None

Source: McFarland-Johnson Analysis, 2013.
** - If Runway 10R-28L is converted from a runway to another use, the ultimate requirement would revert to zero.*

Application of the ACRP Model

The ACRP Model is designed to determine terminal requirements by functional area based on historical and forecasted annual enplanements, departures, and gates. The Model uses these inputs (along with a variety of assumptions) to identify peak hour activity. From this point, the Model relies on peak hour activity levels to produce space requirements that can accommodate demand as it grows. In this way, the Model serves as "top down" analysis, starting with annual demand to zero-in on peak activity demand.

For NFIA, the combination of limited historical passenger activity levels and only recent scheduled service dictates that the Model be applied differently here. In this regard, a "bottom-up" analysis was performed that builds on the Airport's known peak hour period –when both gates are being utilized simultaneously. Facility requirements were determined using the assumptions shown in **Table 5-10** for peak hour departures.

While annual originating and departing passenger activity at NFIA is anticipated to increase, passenger and aircraft movement forecasts (Chapter 4, *Air Traffic Forecasts*) are not high enough to produce a usable assessment of the NFIA terminal facility's capacity. This is because the future air traffic activity levels are highly contingent upon how the market responds over time and what types of new air service might be introduced at NFIA. Using the peak hour and annual activity assumptions shown in **Table 5-10** proved a better means for assessing the NFIA terminal facility's capacity in the future.

Table 5-10 Peak Hour, Daily, and Annual Activity Assumptions

Departures & Passengers	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Peak Hour Departures	2	2.5	4
Peak Hour Originating/Departing Passengers	354	443	708
Daily Departures	10	12.5	20
Daily Originating/Departing Passengers	1,770	2,212	3,540
Annual Departures	3,650	4,562	7,300
Annual Originating/Departing Passengers	134,620	233,753	342,854

Source: McFarland-Johnson Analysis, 2013.

Level of Service (LOS) Standards

The International Air Transport Association (IATA) has developed and refined a comprehensive set of standards for planning various passenger processing functions for airport terminal buildings and is typically used as the standard for most terminal space planning issues. These standards are presented in the IATA *Airport Development Reference Manual*, 9th Edition, published in January 2004. These standards apply primarily to calculation of passenger queuing areas and circulation space and are intended to control passenger densities to enhance individual passenger comfort.

- A = Excellent level of service. Conditions of free flow, no delays and excellent levels of comfort
- B = High level of service. Conditions of stable flow, very few delays and high levels of comfort
- C = Good level of service. Conditions of stable flow, acceptable delays and good levels of comfort
- D = Adequate level of service. Conditions of unstable flow, acceptable delays for short periods and adequate levels of comfort
- E = Inadequate level of service. Conditions of unstable flow, unacceptable delays and inadequate levels of comfort
- F = Unacceptable level of service. Conditions of cross-flows, system breakdown and unacceptable delays; unacceptable level of service

Table 5-11 provides the IATA LOS Standards and Definitions for various passenger processing conditions included in this analysis.

Table 5-11 IATA Space Standards with LOS Definitions (in square feet per person)

Functional Area	A	B	C	D	E	F
Check-in Queuing	19	17	15	13	11	Unserviceable
Wait/Circulate	29	25	20	16	11	Unserviceable
Holdroom	15	13	11	9	6	Unserviceable
Bag Claim	22	19	17	15	13	Unserviceable

Source: International Air Transport Association" Airport Development Reference Manual", 2004.

Terminal area requirements will be based on maintaining LOS "C" as recommended by IATA, due to the stable flow, good levels of comfort and acceptable delay, unless otherwise noted.

5.3.2 Assumptions

Percentage of Originating Passengers and Load Factors

For purposes of analyzing passenger terminal space requirements, it is assumed that 100 percent of enplaned passengers are originating. The originating passenger percentage is used to determine the number of passengers who pass through check-in processing and security screening, thereby affecting facility capacity requirements.

Load Factor

Typically, load factors for the peak month and the average day of the peak month (ADPM) are greater than the annual averages, reflecting increased demand during seasonal peak travel. While data presented in Chapter 4, *Air Traffic Forecasts,* indicates that load factors will remain constant at 85 percent, for the purpose of analyzing passenger terminal space requirements (primarily holdroom sizing for seating), a load factor of 100 percent was applied to calculations in the Model.

Holding the load factor constant through the forecast period serves as an allowance for highest peak activity use, given limited historical data.

Vehicle Demand at Terminal Curb

Vehicle demand in the Model is comprised of private automobiles, rental car shuttles, limousines, taxis, hotel shuttles, airport shuttles, and buses. For this analysis, a focus was placed on private autos, taxis, hotel shuttles, and buses as a representative split among all options available in the Model. **Table 5-12** illustrates the breakdown of vehicle demand at the curb through the forecast period.

Table 5-12 Peak Hour Vehicle Volume Assumptions

Vehicle Type	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Private Auto	120	150	200
Taxi	8	10	12
Limousine	4	6	8
Hotel Shuttle	4	5	8
Airport Shuttle	6	8	12
Bus	2	3	5
Total	**144**	**182**	**245**

Source: McFarland-Johnson Analysis, 2013.

Passenger Check-in Preferences

In order to analyze passenger processing requirements for check-in facilities, it is necessary to determine how this demand will be distributed between staffed airline counters, kiosks, and online transactions. For the purpose of analyzing the terminal's capacity over the forecast period, a steady distribution was assumed, as follows:

- Staffed Counter Position Use 40%
- Kiosk Position Use 40%
- Online Check-In/Off-Site Use 20%

Holding this distribution constant through the forecast period serves as an allowance for highest peak activity use, given limited historical air service patterns to observe and quantify.

Passenger Security Screening Checkpoints

The following assumptions were utilized to analyze the future demand for security screening of departing passengers. The assumed processing rate for the analysis is 275 persons per lane per hour and is based on information provided by the Transportation Security Administration (TSA) during a data collection interview as noted in Chapter 2. The percentage assumed for employees, crew, etc. is five percent which was added to the design peak hour passenger screening demand and is based on recent experience at other airports.

Assumptions for peak 30-minute originating passengers from check-in for each forecast period are as follows:

- Year 5: 113
- Year 10: 142
- Year 20: 227

In terms of existing conditions, a security queue depth of five feet was assumed, along with a 25-foot width per lane, an overall length of 50 feet, and a reconciliation depth area of ten feet. Based on a LOS C, the passenger space required was set at 10.8 square feet per passenger.

Outbound Baggage and Checked Bag Screening Assumptions

In terms of Explosive Detection System (EDS), On-Screen Resolution (OSR), and Explosives Trace Detection (ETD) equipment requirements, the analysis assumed a Level 1 EDS screening rate of 130 bags per hour, with an alarm rate of 25 percent. Level 2 OSR rate was set at 60 bags per hour per operator, with 90 percent of OSR bag reviews being resolved. For Level 3 ETD screening, the TSA suggests 24 bags per hour per operator.

Baggage screening space requirements contained in the Model are as follows:

- Level 1 Area: 800 SF per EDS Unit
- Level 2 Area: 40 SF per OSR Station
- Level 3 Area: 100 SF per ETD Unit

For outbound baggage volume the following assumptions in **Table 5-13** were used.

Table 5-13 Outbound Baggage and Screening System Assumptions

Item for Analysis	Assumption
Peak Hour Passengers Checking Bags[1]	75%
Checked Bags Per Passenger[2]	1.0
Peak Hour Departure Operations	Table 5-1
Bag Size – Standard	90%
Bag Size – Oversized	5%
Bag Size– Out-Of-Gauge	5%

Source: McFarland-Johnson Analysis, 2013.
Notes: [1] Number of checked bags remains constant over the period.
[2] It has been identified that certain legacy airlines are currently observing lower 'checked bag per passenger' quantities; For planning purposes, the higher quantity has been used.

With regard to checked baggage make-up, the analysis assumed three baggage carts for one flight and four for two departures (such that staging through one gate allows carts to be reused during the operation). The Model suggests that each cart requires 600 square feet of space. An additional ten percent of square footage is included for baggage train circulation.

Inbound Baggage

For inbound baggage, the Model considers not just terminating passengers with checked baggage but also includes an allowance for additional people at baggage claim who are meeting/greeting travelers. The industry standard for planning baggage claim area is to add 20 percent above the volume of passengers with checked bags for 'meeters/greeters'. However, since a significant number of the NFIA passengers are Canadian and have driven an hour or so to the Airport and service out of NFIA is primarily the origination of their trip, this standard was reduced to ten percent. The following assumptions in **Table 5-14** were used to analyze the future demand for inbound baggage claim devices and passenger waiting area. The analysis assumed 50 percent of passengers will deplane in a peak 20-minute period, with 100 percent of passengers terminating at the Airport.

Table 5-14 Inbound Baggage System

Item for Analysis	Assumption
Bags per passenger[1]	1.0
Meeter/Greeter Ratio	10%

Source: McFarland Johnson Analysis, 2013.
Notes: [1] It has been identified that certain legacy airlines are currently observing lower 'checked bag per passenger' quantities; for planning purposes, the higher quantity has been used.

The Model for baggage claim area requirements also includes an estimate of use time per flight. To do so, the Model uses inputs previously noted of one bag for 75 percent of passengers. To account for bags not retrieved on the first rotation of the claim unit a buffer of up to ten minutes is considered typical. An unload rate of seven bags per minute is also included.

Holdrooms

Holdroom seating demand was based on assuming a 100 percent load factor for the A320 aircraft configured for 177 seats. Seating was estimated to be provided for 75 percent of passengers with additional standing space for 25 percent of passengers. Planning factors of 15 square feet per seated passenger and ten square feet (SF) per standing passenger were used. An additional square footage allowance was included for amenities such as work stations, charging stations, children's play areas, gate check-in podium, and boarding queue/gate egress area.

Terminal Circulation

For estimating terminal circulation, the Model offers options for a single-loaded versus double-loaded concourse, offers an "Airport Hubbing Activity Factor," and an allowance for moving walkways. For NFIA, a single-loaded concourse was selected, the hubbing factor (connecting flights) was set to zero, and no allowance was included for moving walkways.

In terms of existing conditions, an estimated terminal corridor width of 35 feet and length of 130 feet was input into the Model. Additionally, 100 percent of the concourse is considered usable by passengers.

5.3.3 Results of Analysis

The results of NFIA's terminal capacity assessment are organized by functional area in **Table 5-15** through **Table 5-20**, and are accompanied by descriptions in the sections that follow.

- Terminal Curb
- Airline Check-in & Ticketing
- Outbound Baggage System & Baggage Make-Up
- Passenger Security Screening
- Holdrooms
- Inbound Baggage Systems & Baggage Claim
- Concourse & Circulation Areas
- Gates

Terminal Curb

The first part of accommodating passenger activity levels at NFIA is servicing vehicle traffic for departing passengers at the terminal curb. Incoming traffic is comprised of a range of different vehicles and the Model incorporates assumptions regarding the total volume, peak 15-minute volume, dwell time by type of vehicle, a multiple stop factor (for shuttles and/or taxis accommodating passengers flying on different airlines), and vehicle length. **Table 5-15** shows the assumptions for peak hour vehicle volumes by type used in the analysis. As a percentage of total vehicle demand, it was assumed that 35 percent of all vehicles will utilize the curb in a peak 15-minute period. Additionally, the existing curb length was estimated at 350 feet, which includes the striped usable areas. **Table 5-15** displays the Model's results of the existing terminal curb's ability to accommodate vehicle traffic in each peak hour.

Table 5-15 Terminal Curb Performance

Curb Requirements	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Design Hour Demand in Vehicles	144	182	245
Existing Curb Length	350 ft.	350 ft.	350 ft.
Required Curb Length for LOS C	251-297 ft.	322-381 ft.	445-525 ft.
Performance	A	C	D

Source: McFarland-Johnson Analysis, 2013.

As shown, the existing length of usable curb outside the terminal building will remain adequate with 2.5 peak hour departures, but will likely require expansion to accommodate four peak hour departures.

Recommendation: Expand the available terminal curb length to accommodate four peak hour departures.

Airline Check-In and Ticketing

Once passengers enter the terminal building, it is important that airline check-in and ticketing facilities can adequately serve demand during peak travel times. The results of the Model analysis are presented in **Table 5-16**.

Table 5-16 Airline Check-In/Ticketing

Staffed Counter Positions	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
% Passengers Using Staffed Counter Positions	40%	40%	40%
Existing Staffed Counter Positions	12	12	12
Required Staffed Counter Positions	4	4	7
Performance	Adequate	Adequate	Adequate
Existing Passenger Queue Area	400 SF	400 SF	400 SF
Required Passenger Queue Area	194 SF	332 SF	820 SF
Performance	Adequate	Adequate	More Needed
Kiosks	**Peak Hour 2020**	**Peak Hour 2030**	**Peak Hour 2040**
% Passengers Using Kiosks	40%	40%	40%
Existing Kiosks	4	4	4
Required Kiosks	4	5	7
Performance	Adequate	More Needed	More Needed
Existing Passenger Kiosk Queue Area	220 SF	220 SF	220 SF
Required Passenger Kiosk Queue Area	205 SF	257 SF	610 SF
Performance	Adequate	More Needed	More Needed

Source: McFarland-Johnson Analysis, 2013.

The analysis reveals that the total existing ticket counter frontage is sufficient to support airline check-in practices with four departures per peak hour. As described in the explanation of Assumptions this is based on a level of constant use by 40 percent of passengers through the forecast period.

It can be expected that passenger use of advance ticket purchase and off-site check-in options will continue to increase in the future. This will likely lead to a reduced need for traditional staffed ticket counters and an increase in demand for kiosk-style check-in units. The terminal is currently well equipped (with 12 counter positions) to accommodate nearly 1.3 million annual passengers (four departures per peak hour) if usage remains at 40 percent of passengers.

Recommendation: Passenger check-in profiles have been drastically changing through increased use of mobile and self-service technology. This analysis is based on a more conservative approach based on current methods, it is recommended that check-in technology and trends be monitored and revaluated as the number of airlines and passengers grow.

Table 5-17 shows that passenger queue area at check-in will need to be expanded once passenger levels exceed 1.3 annual passengers.

Table 5-17 Baggage Screening Performance

Baggage Screening	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Existing Area for Levels 1, 2, and 3 Screening	1,665 SF	1,665 SF	1,665 SF
Required Area for Levels 1, 2, and 3 Screening	1,920 SF	2,760 SF	3,600 SF
Performance	More Needed	More Needed	More Needed

Source: McFarland-Johnson Analysis, 2013.

In terms of kiosk check-in, the analysis indicates that there will be an increased need for kiosk units once departures exceed two in the peak hour. As with staffed counter positions, the assumption is that passenger use of kiosks will remain constant over the forecast period. Doing so provides allows the terminal's check-in facilities to meet peak period demands.

Installing island-style units prior to staffed ticket counters and queuing area may reduce check-in and ticketing area expansions and should be monitored over time at NFIA.

Recommendation: Add 420 SF of passenger queue area when NFIA experiences four peak hour flights. Add one kiosk (and 37 square feet of queuing area) when NFIA expects 2.5 peak hour flights and add three kiosks (and 390 square feet of queuing area) when NFIA expects four peak hour flights.

Outbound Baggage System and Baggage Make-Up

Outbound baggage systems are comprised of equipment that support the airlines' departures baggage operations. These include the conveyors that transport baggage from the departures hall to the outbound make-up bag rooms and TSA equipment that screens all outbound baggage. The Model links spatial and equipment requirements for outbound baggage to design hour departing passengers.

Additionally, since baggage handling systems work most efficiently under a certain threshold (e.g., 80 percent of capacity), the Model applies the TSA surge factor. The surge factor takes into consideration unforeseen increases in baggage check-in, such as a tour group checking-in. Per TSA's *Planning Guidelines and Design Standards (PGDS) for Checked Baggage Inspection Systems* (CBIS), a surge factor of 1.21 is applied to the peak hour baggage volume.

Baggage Security Screening

The TSA baggage screening process is defined as a three stage process. In the first level of screening, bags pass through an Explosives Detection System (EDS). After passing through the machine, a portion of the bags will be cleared and routed to the baggage make-up operations, while the remainder will continue to be transported on conveyors and a second screening operation takes place. The second level of screening is the OSR where further examination of baggage images takes place. At the completion of the Level 2 screening, a portion of the bags will be cleared and diverted toward the baggage make-up operation. The remainder of the bags that have not been cleared through the OSR process will be routed into

the Checked Baggage Reconciliation Area (CBRA) for Level 3 screening. In CBRA, TSA will utilize explosives trace detection to examine bags even further.

The existing baggage screening system at NFIA is categorized as Level 2, as checked bags are swabbing manually by three TSA agents. Near-term funding has been identified for the purchase and installation of one EDS unit, which is included in the Model. The results of the baggage screening capacity assessment are shown in **Table 5-17**.

As shown, baggage security screening spatial requirements exceed current space allocations under peak hour conditions as described previously. Based upon assumptions for the number of passengers checking bags (75 percent) and the average number of bags per passenger (one), two Level 1 EDS units will be required to accommodate two departures per peak hour.

Recommendation: Levels 1, 2, and 3 screening should be expanded by 255 SF for two peak hour flights, by 1,095 SF for 2.5 peak hour flights, or by 1,935 SF with four peak hour flights. One Level 1 EDS should be added for two peak hour flights.

Outbound Baggage Make-up

The key component of the outbound baggage system is the make-up operation, where screened baggage is transferred from check-in via carousels to the loading area where carts are grouped by airline and flight. The existing baggage make-up operations occur on the Arrivals level, at the northeast corner of the terminal. **Table 5-18** presents the results of the Model analysis for baggage make-up.

Table 5-18 Baggage Make-Up Performance

Baggage Make-Up	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Existing Area for Baggage Make-Up	3,678 SF	3,678 SF	3,678 SF
Required Area for Baggage Make-Up	3,300 SF	5,000 SF	6,000 SF
Performance	Adequate	More Needed	More Needed

Source: McFarland-Johnson Analysis, 2013.

As shown, expansion of existing baggage make-up area will be required to meet demand levels with more than two departures per peak hour.

Recommendation: The baggage make-up should be expanded according to the number of peak hour flights. Peak Hour 2 scenario of 2.5 peak hour flights requires an additional 1,322 SF, while four peak hour flights require an additional 2,322 SF.

Passenger Security Screening

As described under Assumptions, the Model evaluates passenger security screening capability based upon: originating passenger volume during a peak 30-minute period, percentage of additional traffic (non-passenger, crew, and employees), an assumed capacity or throughput rate, and a maximum target wait time. The results of the analysis are shown in **Table 5-19**.

Table 5-19 Security Screening Performance

Security Screening Lanes	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Peak Hour Enplanements per Screening Lane	275	275	275
Existing Screening Lanes	1	1	1
Required Screening Lanes	1	1	2
Performance	Adequate	Adequate	More Needed
Security Queue Area	**Peak Hour 2020**	**Peak Hour 2030**	**Peak Hour 2040**
Existing Security Queue per Passenger	2.3 SF	1.1 SF	0.4 SF
Required Security Queue per Passenger	10.8 SF	10.8 SF	10.8 SF
Performance	More Needed	More Needed	More Needed

Source: McFarland-Johnson Analysis, 2013.

As indicated, one screening lane will remain adequate for up to 2.5 departures per peak hour; an additional lane will be required to accommodate four departures per peak hour. In terms of queue area, based on passenger levels entered into the Model, additional security area queuing area will be required for all peak hour scenarios.

Recommendation: An additional screening lane will be required with four peak hour flights. The security queue area presently warrants an additional 8.5 SF per passenger of space. For 2.5 peak hour flights this number would increase to 9.7 SF per passenger, and 10.4 SF with four peak hour flights.

Holdrooms

As previously noted, the evaluation of current holdroom capacity is based on the latest IATA space planning standards utilizing a 100 percent load factor for assigned aircraft. As shown in **Table 5-20**, combined first and second level holdrooms at NFIA will be adequate to accommodate passenger activity with two departures per peak hour. Additional holdroom area will be required once aircraft departures reach four in the peak hour.

Table 5-20 Holdroom Performance

Holdrooms	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Existing Holdroom Area	11,308 SF	11,308 SF	11,308 SF
Required Holdroom Area	6,200 SF	7,700 SF	12,000 SF
Performance	Adequate	Adequate	More Needed

Source: McFarland-Johnson Analysis, 2013.

Recommendation: The holdroom area should be increased by an additional 700 SF with four peak hour flights.

Inbound Baggage System and Baggage Claim

The existing inbound baggage system and claim hall at NFIA is comprised of approximately 6,200 SF and includes two baggage conveyor systems. The claim hall can be divided for use by designated domestic and international claim areas, each with one baggage conveyor.
For the purpose of this analysis, the claim hall was considered a contiguous space where both conveyors could be utilized based upon the scenarios described in the previous section

Assumptions, with each gate in use simultaneously. The results of the analysis are shown in **Table 5-21**.

Table 5-21 Baggage Claim Performance

Baggage Claim	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Total Linear Feet (LF) per Peak Hour Passenger	1.5	1.5	1.5
Average Peak Hour Passengers at Claim	122	153	244
Existing Total Baggage Conveyor Frontage (in LF)	262	262	262
Required Linear Feet to Accommodate 1 Flight	183	229	366
Performance	Adequate	Adequate	More Needed

Source: McFarland-Johnson Analysis, 2013.

The length of existing baggage claim carousels, when combined to serve simultaneous flights, can be expected to remain adequate with more than two departures per peak hour; however, an additional baggage carousel unit is anticipated to accommodate four aircraft per peak hour.

Recommendation: With four peak hour flights, an additional 100 linear feet should be added to the Conveyor Frontage.

Concourse and Circulation Areas

Public spaces include most of the non-revenue producing areas in the passenger terminal including: queuing areas, seating and waiting areas (exclusive of holdroom seating), and circulation corridors (secure and non-secure). The size of some of the public space is directly related to requirements imposed by the peak hour volume of passengers handled, such as the ticket lobby and baggage claim, while other circulation space is required for access to other functional areas. In either case, space must be sufficient to meet applicable life safety codes, avoid pinch points that lead to congestion of passenger flow, and provide the additional space necessary for cross circulation where it cannot be avoided.

Table 5-22 shows how the existing concourse and circulation areas perform in terms of their ability to accommodate passenger demand over the 20 year planning period.

Table 5-22 Concourse/Circulation Performance

Concourse/Circulation	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Existing Concourse Circulation Area	11,754 SF	11,754 SF	11,754 SF
Required Concourse Circulation Area	5,700 SF	7,200 SF	11,400 SF
Performance	Adequate	Adequate	Adequate

Source: McFarland-Johnson Analysis, 2013.

As indicated, existing concourse/circulation area at NFIA should meet demand with four departures per peak hour based on passenger levels assumed in the Model for the analysis.

Recommendations: No changes are recommended for concourse/circulation at the Airport.

<u>Gates</u>

As described in the opening of this section, the assessment of the NFIA terminal is focused on peak hour and annual passenger activity assumptions when both gates are utilized simultaneously with an increasing number of daily departures.

Following these assumptions, the capability of existing terminal gates to accommodate growth in aircraft movements was also assessed based on use by the A320 aircraft. **Table 5-23** shows the results of the analysis for gates at NFIA.

Table 5-23 Gate Performance

Concourse/Circulation	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Peak Hour Simultaneous Flights	2	2.5	4
Peak Hour Originating Passengers (Enplanements)	354	443	708
Existing Gates	2	2	2
Required Gates	2	3	4
Performance	Adequate	More Needed	More Needed

Source: McFarland-Johnson Analysis, 2013.

As shown, existing gates at NFIA should be adequate in the near term, with one additional gate required for 2.5 departures and two additional gates for four departures per peak hour.

Recommendation: To accommodate 2.5 peak hour flights, one additional gate should be added. Four peak hour flights would require the addition of two gates to the existing Gate Area.

5.3.4 Passenger Terminal Facility Requirements Summary

The preceding analysis of passenger terminal space requirements has been applied to provide a summary of future terminal space requirements based on current trends of space utilization and information gathered from discussion with NFIA staff and other airport stakeholders. In terms of areas requiring expansion over the 20-year planning horizon, the analysis indicates the following:

- **Two Departures per Peak Hour:**
  - <u>Outbound Baggage Screening:</u> Additional 255 square feet required.

- Passenger Security Queuing: Additional square footage for passenger security queuing will be required by Year 5. Two EDS units are recommended as funding can be identified.

- **2.5 Departures per Peak Hour**
  - Gates: One additional gate required.
  - Kiosks: One additional kiosk required.
  - Kiosk Queuing: Expansion of 37 SF of passenger queue area required.
  - Outbound Baggage Screening: Additional 1,095 square feet required.
  - Outbound Baggage Make-Up: Additional 1,322 square feet required.

- **Four Departures per Peak Hour**:
  - Terminal Curb: The existing curb length, including striped usable area, should be increased by at least 95 feet.
  - Gates: Two additional gates will be required.
  - Staffed Counter Queuing: Additional 420 SF of passenger queue area for staffed counter positions required.
  - Kiosks: Three additional kiosks required.
  - Kiosk Queuing: Additional 390 SF Passenger queue area for kiosks required.
  - Outbound Baggage Screening: Additional 1,935 square feet required.
  - Outbound Baggage Make-Up: Additional 3,678 square feet required.
  - Passenger Security Lanes: One additional screening security lane required.
  - Holdrooms: An expansion of about 700 square feet may be required.
  - Inbound Baggage System: Expansion of inbound baggage conveyors required to provide a total of 370 linear feet of frontage.

A summary of all functional areas evaluated and facility requirements is summarized in **Table 5-24**. Areas where requirements surpass existing capacity are shown in bold.

5.4 LANDSIDE FACILITY REQUIREMENTS

5.4.1 Auto Parking Requirements

Auto parking facilities are a quintessential component to the overall operation of an airport. All airports strive to provide convenient and economical parking for passengers, but this is especially true for NFIA since Canadian passengers are driving to the airport in part due to the convenience over the much larger and busier Toronto Pearson International Airport. In addition to the passenger convenience, auto parking has the potential to be a key revenue generator for an airport. Undersized or inconvenient parking facilities result in fewer passengers and/or the creation of off–airport parking facilities which reduce revenues for the airport.

This section will discuss the following:

- Existing Parking Areas, Usage, and Capacities
- Historical Parking Data
- Demand Calculation Methodology
- Demand Calculations and Required Spaces

Table 5-24 Summary of Terminal Facility Requirements

Item Description	Existing	Peak Hour 2020	Peak Hour 2030	Peak Hour 2040
Peak Hour Departing Passengers	260	354	443	708
Annual Departing Passengers	86,605	134,620	233,753	342,854
Terminal Space Requirements				
Terminal Curb (LF)	350	251-297	322-381	445-525
Gates	2	2	3	4
Airline Functional Areas				
Staffed Counter Positions	12	4	4	7
Staffed Counter Queuing (SF)	400	194	332	820
Kiosks	4	4	5	7
Kiosk Queuing (SF)	220	205	257	610
Outbound Baggage Screening	1,665	2,580	3,480	4,320
Outbound Baggage Make-Up	3,678	4,000	5,900	7,900
Passenger Security Screening Lanes	1	1	1	2
Per Passenger Security Queuing (SF)	0	10.8	10.8	10.8
Holdrooms (SF)	11,308	6,200	7,700	12,000
Inbound Baggage System (LF)	262	183	229	366
Public/Miscellaneous Space				
Concourse/Circulation (SF)	11,754	5,700	7,200	11,400

Source: McFarland-Johnson Analysis, 2013.

Existing Parking Facilities

Demand for auto parking at NFIA was evaluated based on the use characteristics of the existing auto parking lots. The size and use of each of the existing lots are as follows and can be viewed in Figure 2-13:

- **Lot 1A –** A 167-space lot located east of Lot 1, across from the terminal access road on top of pavement that made up one of the former runways at the airport. This lot acts as short-term parking for meeters and greeters; there is no charge to use this lot as overnight parking is prohibited.

- **Lot 1** – A 238 space lot located directly in front of the new passenger terminal, this contains spaces for the NFTA and airline passengers. Due to its proximity to the passenger terminal, there is a height limitation of six feet two inches. The overhead barrier in place to enforce this size restriction creates complications for snow removal due to the height of the plow trucks used.

- **Lot 2** – A 255 space lot located directly in front of the old passenger terminal, this area served as the primary passenger parking lot prior to the new terminal and associated parking lot construction. The size and operation of this lot is similar to Lot 1, however there is no height restriction.

- **Lot 3** – A 1,100 space lot located off of Niagara Falls Boulevard approximately ¼ mile from the passenger terminal, this lot requires shuttle service to/from the terminal. Lot 3 is only used during peak times due to the cost and added complexity of the shuttle operation. Lot 3 is typically in operation from October through April which represents the busier travel season for NFIA.

Historical Parking Data

The introduction of new passenger service coupled with rapid growth alongside the collapse of a once dominant airline has created many anomalies for passenger use at NFIA trends in recent years.

- **2011** – NFIA experienced rapid growth following airline service introduction. Due to increasing growth, the airport's busy months are not consistent within traditional peaking.

- **2012** - Direct Air, with 50 percent market share at NFIA, ceases operations during the peak season. Allegiant replaces some capacity, but total enplanements are lower than 2011.

- **2013** – Partial year data was available for analysis, so the full peak season demand was analyzed.

Due to the fact that there is no revenue control equipment, less than daily flights, and no daily parking counts, the historical data available to analyze passenger parking trends is based on random samples provided by the parking management company.

Demand Calculation Methodology

Demand calculations used a formula based on demand characteristics rather than limiting the analysis for forecast demand levels.

- **Enplanements/Load Factor** – The formula contains enplanement levels ranging from 100,000 to 500,000 in 50,000 increments and assumes a 95 percent load factor for all flights.

- **Parking Factor** – While NFIA is primarily an outbound travel market, not all passengers are parking at the airport. It is assumed that approximately 30 percent of passengers are either inbound passengers or have arrived at the airport via bus or family/friend dropping them off at the terminal. The demand formula assumes that 70 percent of enplanements are arriving via a car parked at the airport.

- **Occupants/Vehicle** – Using historical data, a 70 percent parking factor was applied, and the average number of enplanements per vehicle was determined to use in the demand formula and subsequent parking calculations. Based on available data the occupants per vehicle resulted in approximately 3.4. This higher number reflects NFIA's leisure-oriented service, including travel groups and families.

- **Duration –** A random sample of NFIA parking ticket receipts was reviewed to more accurately determine the average duration for which vehicles were parked in the parking lots, as the amount of days that a vehicle occupies a particular parking space can greatly affect the number of parking spaces required. Samples were pulled for the months of January (average), March (peak), and June (slow). The average parking duration based on the receipts was as follows:

  - January 8.31 Days
  - March 7.81 Days
  - June 7.08 Days

The demand formula contains an average of eight days for auto parking. It is anticipated that as activity increases, so will the number of flight options creating more choices for passengers. The addition of flights schedule options when booking, especially with less than daily service, has the potential to gradually lower the average duration over time. For higher levels of enplanements, the auto parking demand formula gradually lowers the average duration to seven days at the 400,000 enplanement mark and six days by the 600,000 enplanement level.

Peak Season

The combination of the region's harsh winter climate, NFIA's appeal to Canadian travelers, and school breaks in the early spring, significantly enhance auto parking demand in February, March, April, and occasionally October. Since annual demand does not accurately depict the parking situation during the busy months of the year, the average of the busiest three months was used to address the proper planning levels for airport parking. The average of these busiest three months (regardless of which months) is referred to as the peak season. Available data for NFIA shows the peak season is typically 30-40 percent greater than the average annual daily demand.

Maximum Demand

Available parking records reveal a sharp spike in parking demand during the spring break weeks in March. This period of one to two weeks typically experiences an ultimate peak of up to 20 percent above the average parking demand during the peak season (50 percent greater than the average annual daily demand). Because this peak typically accounts for less than 20 days per year, the cost to construct and maintain lots to satisfy this demand level would not generate a practical return on investment for the airport. Parking requirements should be based on the peak season, with contingency plans and temporary overflow lots to accommodate the maximum demand scenarios. An additional consideration for overflow parking could be a discounted weekly lot with a set weekly rate during peak periods to attract longer duration parkers away from the closer-in spaces.

Planning Thresholds

A planning threshold of 80 percent was applied to the forecast parking lot capacity. Parking lot occupancy can be higher when aircraft departure and arrival times overlap as there is a short time when both groups of passengers have their cars parked. Additionally, the winter months reduce spaces due to accumulation of snow and ice in some spaces.

Total Spaces Required

The combination of the 80 percent planning threshold and peak season (busiest three-month average) was selected as the preferred method to determine the required number of vehicle parking spaces for NFIA. **Table 5-25** displays the auto parking requirements for potential enplanement levels for NFIA. Based on the enplanement levels identified in the forecast, additional auto parking spaces are likely to be required in the intermediate to long range planning period; however, demand should be monitored. Planning for additional parking lots should start as lots reach 80 percent of their capacity.

Table 5-25 Auto Parking Facility Requirements

Enplanements	Peak Season Spaces	Max Peak Spaces
100,000	843	1,012
150,000	1,265	1,518
200,000	1,686	2,023
250,000	1,976	2,371
300,000	2,569	3,083
350,000	2,675	3,210
400,000	3,057	3,668
450,000	3,320	3,984
500,000	3,426	4,111

Source: McFarland Johnson, 2013

Due to the limited amount of data and fluctuations in service, it is recommended that auto parking demands be reevaluated when at least three full years of data can be reviewed.

Recommendation: The following is recommended for auto parking at NFIA:

- Long-Term Peak Season Spaces 3,426 with 500,000 enplanements
- Long-Term Max Peak Spaces 4,111 with 500,000 enplanements

The NFTA is currently exploring the opportunity to purchase one or more of the buildings adjacent to the old and new terminal, which will create additional opportunities for auto parking in front of the terminal and allow easier installation of revenue control equipment. Due to the nature of existing and proposed services offered at NFIA, a dedicated short-term parking lot is not likely to be needed (short-term rates should be offered however). Landside plans should incorporate consolidated auto parking lots into a single lot or two larger lots in front of the terminal. Lot 3, the remote lot, should maintain its existing configuration and function.

5.4.2 Terminal Roadway System

Similar to the auto parking, the shape of terminal roadway system is a function of both the new and old terminals and adjacent buildings. Much of the roadway system requirements and improvements are a result of changes to the auto parking lots; however, key requirements to be considered in the development of landside alternatives include:

- Protect or improve customer experience
- Reduce vehicle circulation

- Limit the number of decision points
- Minimize areas of merging or converging traffic

As previously mentioned, the NFTA is looking to purchase one or more of the buildings that shaped the current roadway configuration. The roadway system improvements are directly related to the consolidation of auto parking lots which will be reflected in the landside alternatives. Should enplanements exceed forecasted levels, a traffic study should be conducted to determine if the existing access interface with Niagara Falls Boulevard is sufficient. At this time, there are no anticipated access/intersection issues anticipated based on the levels identified in the forecast.

Recommendation: No immediate changes to the terminal roadway system are recommended at NFIA.

5.4.3 Rental Car Facilities

When the terminal opened, the service provided was geared primarily toward outbound passengers and there was little to no demand for rental car services. This was evidenced by the single counter operated by Enterprise Rent-a-Car both on and off the airport customers during the first year of service. Since then, Avis/Budget has begun serving NFIA customers utilizing the same general counter area, though their primary base of operations is a facility across the street.

While additional rental car demand is contingent upon growth of the inbound travel market, recent growth warrants planning and identifying potential facility needs. Increased rental car demand could require the following:

- Rental car counters (with office space) for up to three companies (Terminal)
- Dedicated ready-spaces for up to ten spots per company (Landside/Parking)
- Rental car cleaning and staging facility for up to 200 total cars (Landside/Other)

The rental car cleaning/staging facility requirements may vary depending on the type and size of facility operations owned/operated by the rental car companies off airport property. Sites of a potential on-airport (revenue generating) rental car cleaning/staging facility will be shown in the alternatives chapter.

Recommendations: No immediate changes to rental car facilities are recommended at NFIA.

5.5 AIR CARGO REQUIREMENTS

As detailed in Chapter 4, *Air Traffic Forecasts*, the only air cargo activity expected at NFIA is as a result of demand or interest from outside the Airport's market. However, NFIA does offer a suitable location and adequate infrastructure, including abundant land and a primary runway length that can accommodate air cargo operations. In the event that an operator expressed interest and/or pursued investment and development of an air cargo facility on NFIA, the following sections present a conceptual plan and requirements for such a facility.

A prospective air cargo facility should include a variety of components, such as taxiways, ramps, vehicle (truck) access ways, parking areas, etc. It is assumed that the design aircraft for such airside facilities would be the Boeing 747-400 or 747-8, which are categorized as FAA ADGs V and VI, respectively.

5.5.1 Building

An air cargo operation at NFIA would require a building through which cargo can be moved between the aircraft and the trucks that collect and distribute the parcels or in which cargo can be temporarily stored for transfer between aircraft. As the interface between aircraft and the trucking fleet, the building must permit airfield access by the ground service equipment such as K-loaders and tugs, which service the cargo aircraft. It also should provide loading docks with access to the roadway system. Typically, these buildings are long and narrow and located with one long side along the apron and the other along truck maneuvering and parking sites. The size of the building should be sufficient to accommodate offices, storage of servicing equipment, process and store cargo, while also interfacing ramp loading operation of the aircraft. If such a facility will handle international flights, an area for customs and cargo inspection would also be required. Based on facilities located at other airports, conceptual plans should consider a building size of at least 100,000 square feet (SF). Whatever the ultimate size of a prospective air cargo facility, conceptual plans should consider stages of construction that could accommodate expansion should usage increase.

As mentioned, access to and from truck loading and maneuvering area should be provided. The most desirable access would provide for at least a 40-foot roadway within a 50-foot wide right of way leading to a State or U.S. Highway within a few miles of the highway system. Needed loading and maneuvering space will ultimately depend on the size and number of trucks to be accommodated. At this conceptual level, a need for at least eight Interstate semi-trailer trucks and several single-unit trucks docked simultaneously should be planned.

5.5.2 Apron and Pavement

Apron pavement should be sized for two B747-8 aircraft. A total of approximately 13,500 square yards (SY) (121,500 SF) of paved apron would be necessary.

The FAA pavement design program was used to determine the appropriate cross sections for pavement design to support B747-8 aircraft. Due to the weight of the aircraft, rigid concrete pavement is recommended for the ramp areas. For taxiways and taxilanes asphalt pavement may be suitable, although rigid pavement will typically have a longer life. Pavement sections are discussed in **Table 5-26**.

Table 5-26 Apron Pavement Design

Description	Thickness
Rigid Pavement Design – Design Aircraft B 747-8	
PCC Thickness (600 psi conc. flexural strength)	17.0”
Stabilized Base	4.0”
[Stabilized] Subbase	12.0”
Flexible Pavement Design – Design Aircraft B 747-400	
P-401 Plant Mix Bituminous Pavement	5”
P-401 Plant Mix Bituminous Pavement	8”
P-209 Crushed Aggregate Base course	28”

Source: McFarland-Johnson Analysis, 2013.

Recommendations: No immediate changes to accommodate prospective air cargo operators are recommended at NFIA, however, the Alternatives should consider the placement of facilities to accommodate future air cargo demand.

5.6 GENERAL AVIATION REQUIREMENTS

The existing general aviation areas are located on both sides of Runway 6-24, with based aircraft activities occurring on the west side and fueling and fixed base operators on the east side. Due to joint resources such as fueling and maintenance, general aviation facilities are often located in the same area of an airport, especially at commercial service airports. This section discusses the requirements for each of the general aviation elements while the Alternatives chapter will explore the future location of the required facilities. Requirements for GA facilities at NFIA were calculated based on data collected for previous chapters and through consultation with the FBO and NFIA staff. The data collected was compared to FAA standards. The following facilities are discussed in this section:

- Aircraft Hangars
- Aircraft Parking Apron
- GA Terminal
- GA Auto Parking

5.6.1 Aircraft Hangars

General aviation hangars are planned for both based and itinerant aircraft. Requirements were calculated based on the size and quantity of aircraft based at the airport. Given the harsh winter climate at NFIA, it is assumed that all based aircraft will be kept inside hangars. The following planning factors were used to calculate the approximate hangar space requirements for aircraft based at NFIA:

- 1,200 SF for Single-Engine and Rotor Aircraft
- 1,600 SF for Multi-Engine Aircraft
- 2,500 SF for Jet Aircraft

The forecast for based aircraft reflects rather stable conditions for single- and multi-engine aircraft over the planning period. Jet aircraft will account for the majority of growth to eight aircraft by 2032.

In addition to hangar space for based aircraft, a full-service FBO should have the ability to store itinerant aircraft in a hangar overnight. Often times, the aircraft requiring hangar storage are the higher-value business jets such as the Gulfstream V, Citation X, or Bombardier Challenger. Interviews with the FBO indicated this is a common request for casino-related traffic. Covered storage does not necessarily need to be in a dedicated hangar; however, available space for a minimum of two jet aircraft (5,000 SF) is recommended. As activity increases over time, it is anticipated that the demand for itinerant covered storage will increase to 10,000 SF.

Presently, there is no dedicated hangar for aircraft maintenance facilities. As an international airport with a full service FBO, NFIA should have an appropriate maintenance/avionics facility for routine or emergency repair. Similar to itinerant storage, maintenance space does not need to be in a dedicated hangar. Space for a minimum of two jet aircraft or four single-engine aircraft (4,800 - 5,000 SF) is recommended.

Combined, there is a total of approximately 86,000 SF of hangar space at NFIA, the majority of which is private development on land leased from the NFTA. The overall hangar requirements are displayed in **Table 5-27**. The analysis identifies an existing deficiency of approximately 3,000 SF which is consistent with the current occupancy rate of 100 percent and hangar demand identified by the FBO.

Recommendation: An additional 5,000 SF should be provided to accommodate two jet aircraft approximately 5,000 SF for aircraft maintenance, additional space constructed as demand warrants.

Table 5-27 Aircraft Hangar Requirements

Item/Year	Single	Multi	Jet	Rotor	Itinerant (SF)	Maintenance (SF)	Total (SF)
SF/Type	1,200	1,600	2,500	1,200	-	-	-
			Aircraft Hangar Requirements				
2012	63,600	6,400	7,500	1,200	5,000	5,000	88,700
2017	63,600	6,400	8,673	1,200	5,000	5,000	89,873
2022	63,600	6,400	10,481	1,200	5,000	5,000	91,681
2027	63,600	6,400	13,061	1,200	10,000	5,000	99,261
2032	63,600	6,400	16,277	2,400	10,000	5,000	103,677

Source: McFarland-Johnson Analysis, 2013.

5.6.2 Aircraft Parking Apron

With all based aircraft being stored in hangars, the primary purpose for the aircraft parking apron is for itinerant general aviation activity. The 56,031 SY GA apron primarily supports the maneuvering of hangared aircraft; whereas the primary apron to be analyzed for general aviation activity is actually the 23,308 SY Fixed Based Operator apron.

Aircraft parking apron requirements are typically based on 600 SF of apron for what is 50 percent of the general aviation landings (half of GA operations) during the average day of the peak month (ADPM) and an additional 35 to 45 percent for staging and maneuvering. The forecast depicts relatively stable growth over the course of the planning period with approximately 122 ADPM GA operations (61 landings). Based on approximately 30.5 operations, the GA apron demand for the FBO is between 25,500 SY and 27,500 SY.

Recommendation: The GA apron should be expanded by approximately 2,200 to 4,200 square yards. The alternatives chapter will address the proper location for this expansion.

5.6.3 General Aviation Terminal

The existing GA terminal facility is collocated with the main FBO hangar (Hangar A) and consists of approximately 3,000 SF which contains public facilities, management offices, support space, and circulation. As an international airport servicing both business and leisure GA customers, a full-service FBO should provide the following:

- Passenger/Customer Waiting Area

- Flight Planning Room with Weather Information
- Conference Room
- Public Restrooms
- Crew Rest Area/Nap Room with Shower Facilities
- Kitchenette/Vending Area

While many of these services are currently offered, the space is either combined with another element or drastically undersized. These services plus core FBO management requirements of customer service desk, break room, management offices, and storage, result in a facility that is approximately 5,000 SF based on 122 ADPM GA operations.

Aside from the traditional GA functions, the FBO routinely processes chartered passenger flights seating up to 30 passengers; these flights do not utilize the passenger terminal. The existing lounge area in the FBO terminal provides seating for approximately 12 people, which does not meet the 30-passenger requirement for charter passenger flights. In addition to seating constraints, the single-stall restrooms are not sufficient during charter operations. Accommodating charter operations in addition to the GA traffic warrants an approximate 2,000 SF of additional GA terminal space.

It is recommended that a new general aviation terminal spanning approximately 7,000 SF be constructed to replace the aging, small current GA terminal. The Alternatives Analysis chapter will review potential sites and configurations for this new facility.

Recommendation: Construct a 7,000 SF facility to serve as the new GA terminal.

5.6.4 General Aviation Auto Parking

Existing GA auto parking facilities consist of approximately 26 spaces (two of which are handicapped) located in front of the FBO hangar; this parking serves for employees, customers, passengers, and rental car clients. Interviews with FBO staff indicated that this lot is often at capacity during peak times. A planning factor of 50 percent of the ADPM GA operations (122) was used to estimate the number of required GA auto parking spots. It is assumed that 61 total spaces will cover employees, passengers, crew, and rental car services. With a new GA terminal site recommended, the GA auto parking lot should be planned for 61 spaces with additional area for potential expansion should GA activity grow faster than anticipated.

Recommendation: Add 35 additional parking spaces to the GA auto parking or construct 61 spaces on the new GA terminal site.

5.7 SUPPORT FACILITY REQUIREMENTS

This section addresses the facility requirements of support functions at the Airport. These support functions include the following:

- Air Traffic Control Tower (ATCT)
- Aircraft Rescue and Fire Fighting (ARFF)
- Airfield Maintenance

5.7.1 Air Traffic Control Tower

The existing ATCT is approximately 67 feet tall (floor elevation of approximately 40 feet) and was constructed in the 1950s. This facility is located on the southern boundary of the airport, south of all active airport pavements. The height and location create several areas of impaired operational visibility. Interviews with ATCT personnel indicated that the height of the tower creates a low angle of incidence for the complex intersection of runways and taxiways near Runways 24 and 28R. In addition, it was indicated that there is poor visibility to the Runway 10L end, partially caused by vegetation.

The age of the facility combined with its height and location warrant further analysis for a new, taller ATCT with improved visibility to all airfield pavements. The Alternatives Analysis chapter will consider potential sites for a new ATCT and will assess potential improvements to alleviate concerns regarding its existing location.

Recommendation: Assess the potential sites to construct a new, taller ATCT with improved airfield visibility.

5.7.2 Aircraft Rescue and Fire Fighting

Aircraft Rescue and Fire Fighting (ARFF) at NFIA is provided by the U.S. Air Force from their facility northwest of the intersection of Runways 10L-28R and 6-24. The services are provided as part of the Airport Joint Use Agreement between Niagara Frontier Transportation Authority (NFTA) and the U.S. Air Force.

The FAA has established specific requirements for ARFF equipment as part of Title 14 of the Code of Federal Regulations, Part 139, *Certification of Airports.* The requirements vary depending on the frequency and size of aircraft that regularly use the airport for scheduled commercial airline service. The requirements are broken down into five categories based on the length of the largest scheduled aircraft. If the frequency of the largest scheduled aircraft is less than five departures daily, the requirements for ARFF equipment revert to the next lowest index. Currently, the longest aircraft scheduled providing commercial airline service is the MD-80 series (approximately 148 feet long). NFIA is required to adhere to the requirements of Index B as there are less than five daily departures of the Index C MD-80 aircraft.

Index B requirements can be met through two methods. One method is to utilize one vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of aqueous film forming foams (AFFF) for foam production. The second method is to utilize two vehicles: one carrying the extinguishing agents as specified previously and a second carrying an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons.

For the future, the design aircraft has been identified as the Boeing 767-300ER (180 feet long), an Index D aircraft. It is not anticipated that aircraft within Index D will complete five daily departures from NFIA, which would reduce the ARFF requirements to Index C. Index C requirements can also be met through two methods. The first method is to utilize two vehicles: one vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of AFFF for foam production and the second vehicle carrying water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 3,000 gallons. The second method is to provide three vehicles. The first vehicle will carry 500 pounds of sodium-based dry chemical, halon 1211, or clean agent or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of AFFF to total 100 gallons for simultaneous dry chemical and AFFF application. The other two vehicles will each carry an amount of water

and the commensurate quantity of AFFF so the total quantity of water for foam production carried by all three vehicles is at least 3,000 gallons.

While current FAA requirements mandate that NFIA provide ARFF protection at Index B, the current U.S. Air Force ARFF capabilities meet the requirements for Index E, which are capable of providing coverage to the largest commercial aircraft flying. No further improvements or changes will be required while the U.S. Air Force is providing ARFF services at NFIA.

Recommendations: No changes to ARFF capabilities are recommended at NFIA so long as the U.S. Air Force continues to provide such services.

5.7.3 Airfield Maintenance Facility and Equipment

The NFIA airport operations staff performs the day-to-day responsibilities of maintaining and inspecting the facilities owned by NFIA. In addition, NFIA is responsible for the removal of snow on Runway 10L-28R and Taxiway A, A1, A2, and A3 between the hours of 4:00pm and 7:15am Monday through Friday and all day on Saturday and Sunday. The U.S. Air Force completes snow removal during the other period. As such, it is still required that NFTA maintain a snow removal fleet capable of meeting FAA requirements for the removal of snow within one hour of snowfall. As of June 2013, NFIA owned several pieces of snow removal equipment (SRE) as included within NFIA's approved Snow and Ice Control Plan. This equipment includes six plows ranging in model year from 1995 to 2012; four blowers dating from 1983 to 2013; and three brooms with model years from 1993 until 2010. This also includes two loaders (1995 and 2005). According to NFIA's Snow and Ice Control Plan, the Airport includes approximately 3.5 Million square feet of critical snow removal areas identified as the first priority for snow removal. Based on FAA standards for the minimum amount of SRE available to remove snow within one hour on the critical snow removal areas (as required as a commercial service airport with less than 40,000 annual operations, but greater than 10,000 annual operations), assuming the primary blower is capable of removing 3,000 tons per hour with a 100 foot casting distance, the current fleet of SRE is not adequate in all categories. Per the requirements of AC 150/5220-20, the fleet meets or exceeds the requirements for rotary plows, displacement plows, and front end loaders, but is lacking with regards to brooms and materials spreaders, where five brooms and materials spreaders are deemed as required versus the three brooms and two materials spreaders available. Per the FAA requirements, one broom and one materials spreader is eligible per 750,000 square feet of pavement (rounded up) within the critical snow removal areas. All other equipment show be replaced as necessary due to age as well as wear and tear. A breakdown of the equipment identified as necessary as identified via AC 150/5220-20 is available in **Figure 5-28**.

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Table 5-28 Snow Removal Equipment Facility Requirements

Equipment Type	Current Number in Fleet	Facility Requirement
Rotary Plow	3	3
Displacement Plow	7	6
Sweeper	3	5
Front End Loader	2	1
Materials Spreader	2	5

Note: Two Displacement Plows are dedicated to roads and parking lots outside of the Priority One Clearing Area
This assessment assumes rotary plows are identified as Class 4 (with a capacity of up to 3,000 tons/hour and a 100' casting distance.
Source: Niagara Falls International Airport Snow and Ice Control Plan, McFarland Johnson, 2016

NFIA currently utilizes an Airport Maintenance Facility/SRE Building to house its equipment west of the Runway 6 end, near the West Ramp. The facility was constructed in what was previously the runway object free area (ROFA) for Runway 6-24 prior to the recent shift of the runway. During interviews with airport management, the need for additional space within the existing facility was not identified as a constraint. However, it was noted that several pieces of airport equipment are commonly parked outside of the facility along the pavement edge. With the climate in Niagara Falls and the potential impact to these vehicles parked outside during cold weather, it is important to ensure that space is available for all vehicles to park indoors at NFIA. The existing Airport Maintenance Facility/SRE Building is approximately 17,300 SF in size. Based on recommending sizing calculations in FAA AC 150/5220-18A, *Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials,* Niagara Falls is designated as a "Very Large-Sized Airport" due to the presence of over one million square feet of paved runway. It is recommended that NFIA pursue an expansion of the facility to approximately 36,000 SF to accommodate the existing fleet of snow removal and maintenance equipment and associated tools and parts. Included within this space, following the guidelines and definitions provided in AC, is approximately 25,000 SF of space to accommodate vehicle storage, approximately 9,500 SF of space to accommodate support items, and approximately 1,500 SF of space to accommodate material storage items and special equipment items.

Recommendation: Add an additional two (2) brooms and three (3) materials spreaders to the fleet of Snow Removal Equipment. Expand the maintenance/SRE building by approximately 18,700 SF.