Chapter 5:
Facility Requirements

5.1 Introduction

This chapter presents the airside and landside facility requirements necessary to accommodate existing and forecasted demand at Burlington International Airport (BTV or the Airport) in accordance with Federal Aviation Administration (FAA) design criteria and safety standards. The facility requirements are based upon several sources, including the aviation demand forecasts presented in Chapter 3, *Aeronautical Forecasts;* FAA Advisory Circular (AC) 150/5300-13A, *Airport Design;* and 14 Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace.* The findings of this chapter serve as the basis for the formulation of airport alternatives and development recommendations. The major components of this chapter are listed below:

- Airside Facility Requirements
- Passenger Terminal Facility Requirements
- Parking and Roadway Access Facility Requirements
- General Aviation and Landside Facility Requirements
- Support Facilities
- Forecast Scenario Facility Requirements
- Facility Requirements Summary

5.2 Airside Facility Requirements

Airside facility requirements address the items that are directly related to the arrival and departure of aircraft, such as runways and taxiways and their associated safety areas. To ensure that all runway and taxiway systems are correctly designed, the FAA has established criteria for use in planning and designing airfield facilities. Selecting the appropriate FAA design standards for developing airfield facilities is based on the characteristics of the most demanding aircraft that is expected to regularly use[31] an airport or a particular facility at an airport. Correctly identifying the future aircraft use an airport is particularly important because the design standards that are selected establish the physical dimensions of facilities and the separation distances between facilities that impact airport development for years to come. Using appropriate standards will ensure that facilities can safely accommodate aircraft using the Airport today, as well as aircraft that are projected to use 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 of aircraft into runway design codes (RDC). The RDC consists of a letter representing an aircraft approach category (AAC) which is based on approach speed, a number representing an airplane design group (ADG) which is 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** below.

Table 5-1: Runway Design Code Characteristics

[31] Regular use of an airport is at least 500 operations in the most recent 12-month period.

Aircraft Approach Category (AAC)	
Category	**Approach Speed**
A	Approach speed less than 91 knots
B	Approach speed 91 knots or more but less than 121 knots
C	Approach speed 121 knots or more but less than 141 knots
D	Approach speed 141 knots or more but less than 166 knots
E	Approach speed 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
4000	Lower than 1 mile but not lower than ¾ mile (APV ≥ 3/4 but < 1 mile)
2400	Lower than 3/4 mile but not lower than 1/2 mile (CAT-I PA)
1600	Lower than 1/2 mile but not lower than 1/4 mile (CAT-II PA)
1200	Lower than 1/4 mile (CAT-III PA)

Source: FAA AC 150/5300-13A Airport Design

Not all Airport facilities will be designed to accommodate the most demanding aircraft at the Airport. Certain airside facilities and landside facilities, such as taxiways and general aviation areas that are not intended to serve large aircraft, may be designed to accommodate less demanding aircraft, where necessary, to ensure cost effective development. 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 Length
- Runway Width
- Runway Strength
- Runway Orientation
- Runway Safety Areas
- Runway Object Free Areas
- Runway Protection Zones
- Runway Visibility Zones
- Runway Pavement Markings
- Taxiways
- Potential Hot Spots and Geometry Requirements
- Airfield Lighting and Signage
- Visual Approach Aids

- Airfield Facility Requirements Summary

5.2.2 Runway Length

A wide variety of aircraft use BTV daily. These different sized aircraft have different runway requirements. In some cases, smaller or older aircraft may require more runway length than larger or more efficient aircraft. A significant number of factors go into determining the runway length for an aircraft. These include airport elevation, aircraft weight, temperature, flap settings, payload, and runway condition (wet/dry).

The FAA has published AC 150/5325-4B, *Runway Length Requirements for Airport Design*, to assist in the determination of the required runway length for both the primary and crosswind runways. The requirements for both the primary and crosswind runways are based on the performance of a specific aircraft or a family of similar aircraft.

As noted in Chapter 3, *Aeronautical Forecasts*, the existing and future design aircraft for Runway 15-33 is the Boeing 757-200 (B757). In addition, the Airbus 320-200 and Boeing 737-800 were reviewed based on current and anticipated future operations.[32] The existing and future design aircraft for Runway 1-19 is the Cessna 172.

Boeing 757-200 – This is the design aircraft for Runway 15-33 and drives the current RDC C-IV-2400. Maximum takeoff weight (MTOW) is 220,000 pounds to 255,000 pounds, depending on the engines. FAA AC 150/5325-4B requires the airplane manufacturer's planning manual to be consulted for runway length requirements for aircraft with MTOW greater than 60,000 pounds.

Fedex regularly operates the B757 aircraft between BTV and Memphis. Per the B757's Airport Planning Manual, at the mean daily maximum temperature of the hottest month of the year (81 degrees Fahrenheit[33]) and an Airport elevation of 335 feet, the runway length required can go up to 6,700 feet (in dry conditions)[34] and 7,705 feet on a contaminated runway. Runway 15-33 is 8,319 feet long and therefore can accommodate B757 operations.

Airbus 320-200 – This aircraft has over 500 operations at the airport. Based on operations to Denver and full payload, the runway length was reviewed for 162,000 pounds. FAA AC 150/5325-4B requires the airplane manufacturer's planning manual to be consulted for runway length requirements for aircraft with MTOW greater than 60,000 pounds.

Per the A320's Airport Planning Manual, at the mean daily maximum temperature of the hottest month of the year (81 degrees Fahrenheit[35]) and an Airport elevation of 335 feet, the runway length required can go up to 6,500 feet in dry conditions[36] and 7,475 feet on a contaminated runway. Runway 15-33 is 8,319 feet long and therefore can accommodate A320 operations.

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[32] Runway lengths are not adjusted for changes in runway elevation.
[33] U.S. Climate Data: https://www.usclimatedata.com/climate/burlington/vermont/united-states/usvt0033, accessed Jan. 16. 2019.
[34] Boeing 757-200/300 Airplane Characteristics for Airport Planning, August 2002.
[35] U.S. Climate Data: https://www.usclimatedata.com/climate/burlington/vermont/united-states/usvt0033, accessed Jan. 16. 2019.
[36] Airbus A320 Aircraft Characteristics Airport and Maintenance Planning, May 1, 2015.

Boeing 737-800 – This aircraft is the highest use of the Boeing 737 aircraft flew into BTV in 2018 (over 400 operations of over 700 annual operations). Based on operations to Denver and full payload, the runway length was reviewed for 168,000 pounds. FAA AC 150/5325-4B requires the airplane manufacturer's planning manual to be consulted for runway length requirements for aircraft with MTOW greater than 60,000 pounds.

Per the B737-800's Airport Planning Manual, at the mean daily maximum temperature of the hottest month of the year (81 degrees Fahrenheit[37]) and an Airport elevation of 335 feet, the runway length required can go up to 7,500 feet in dry conditions[38] and 8,625 feet on a contaminated runway. Runway 15-33 is 8,319 feet long and therefore can accommodate B737 operations.

Cessna 172 Skyhawk - This is the design aircraft for Runway 1-19 and drives the current RDC A/B-I(S)-5000. MTOW is 2,550 pounds[39] and therefore falls into Chapter 2 guidelines of FAA AC 150/5325 4B for small aircraft with a maximum certificated takeoff weight of 12,500 pounds or less and approach speeds of 50 knots or more.

At an elevation of 335 feet and using the mean daily maximum temperature of the hottest month of the year (81 degrees Fahrenheit[7]), the recommended takeoff distance available for the Cessna 172 Skyhawk is 3,025 feet.

Existing services and operations at the Airport operate safely and efficiently from both Runways 15-33 (8,319 feet long) and 1-19 (4,112 feet long).

Recommendation: There are no changes recommended to the runway length. As pavements reach the end of their useful life, mill and overlay of both runways will be required within the planning period. Runway 1-19 funding for rehabilitation may not cover the full runway length.

5.2.3 Runway Width

Runway 15-33 is 150 feet wide, which meets C-IV-2400 requirements. Runway 1-19 is 75 feet wide, which meets and exceeds A/B-I(S)-5000 requirements.

Recommendation: Both runways meet FAA requirements. There are no changes recommended for the runway width.

5.2.4 Runway Strength

Pavement strength requirements are related to three primary factors: 1) the weight of aircraft anticipated to use an airport, 2) the landing gear type and geometry, and 3) the volume of aircraft operations. Airport pavement design, however, is not predicated on a particular weight that is not to be exceeded. The current methodology used in FAA's FAARFIELD airfield pavement design program analyzes the damage to the pavement for each airplane and determines a final thickness for the total cumulative damage per FAA AC 150/5320-6F, *Airport Pavement Design and Evaluation*.

[37] U.S. Climate Data: https://www.usclimatedata.com/climate/burlington/vermont/united-states/usvt0033, accessed Jan. 16. 2019.
[38] Boeing 737 Aircraft Characteristics Airport Planning, September 2013.
[39] FAA Aircraft Characteristics Database, October 2018.

Design is based on the mix of aircraft that are expected to use the runway over the anticipated life of the pavement (usually 20 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 an airport. This may or may not be the design aircraft for planning purposes and its selection considers the type of landing gear and tire pressure in addition to 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.

The current pavement at the Airport is rated for 100,000 pounds single-wheel, 175,000 pounds dual wheel, and 355,000 pounds dual tandem for Runway 15-33. Runway 1-19 pavement strength information is shown in **Table 5-2.**

Table 5-2: Runway 1-19 Pavement Strength

Runway 1-19	Remaining	South of Runway 15-33 Intersection to Taxiway C	South of Taxiway C intersection to South end of Runway
Single Wheel	30,000 pounds	100,000 pounds	30,000 pounds
Dual Wheel	40,000 pounds		60,000 pounds
Dual Tandem	60,000 pounds	355,000 pounds	

Source: FAA Airport/Facility Directory effective Nov. 8, 2018 – Jan. 3, 2019

According to the Airport's FAA 5010 Form, *Airport Master Record,* both runways are listed in good condition.

The Runway 15-33 critical aircraft is the B757, which has a MTOW of up to 255,000 pounds and a dual tandem wheel configuration. This is below the 355,000 pounds dual tandem Runway 15-33 is rated for. The Runway 1-19 critical aircraft is the Cessna 172 Skyhawk which has a maximum takeoff weight (MTOW) of 2,550 pounds for both variants of the aircraft.

Recommendation: There are no changes recommended to the runway strength.

5.2.5 Runway Orientation

A significant factor in evaluating a runway's orientation is the direction and velocity of the prevailing winds. Ideally, all aircraft take off 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. A common way to measure the degree to which a runway is aligned compared to 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 percent wind coverage.
Wind data for the Airport was obtained from the National Climatic Data Center (NCDC) in Asheville, North Carolina. The wind data was collected for a 10-year period from 2008 through 2017 at Burlington International Airport. The wind data shows the percentage of time winds at the Airport originated from different directions at various velocities. These percentages were then analyzed based on runway orientation and can be seen in **Table 5-3**. Ideally, the primary instrument runway at an airport should be

the runway that has the highest percentage of wind coverage under instrument flight rules (IFR) conditions, during which an approach procedure is needed.

Table 5-3: Runway Wind Coverage Analysis

	All Weather Wind Coverage[1]				IFR Wind Coverage[2]			
	10.5 Knot	13 Knot	16 Knot	20 Knot	10.5 Knot	13 Knot	16 Knot	20 Knot
Runway 15-33	92.88%	97.11%	99.36%	99.60%	95.71%	98.41%	99.67%	99.96%
Runway 15	53.96%	57.21%	59.06%	59.59%	42.91%	43.94%	44.60%	44.79%
Runway 33	58.23%	59.22%	59.61%	59.68%	72.14%	73.81%	74.41%	74.51%
Runway 1-19	97.19%	98.73%	99.80%	99.96%	97.76%	98.96%	99.78%	99.97%
Runway 1	57.11%	58.33%	59.10%	59.24%	72.10%	73.11%	73.96%	73.90%
Runway 19	59.41%	59.73%	59.99%	60.06%	45.00%	45.20%	45.36%	45.42%
Both	99.40%	99.78%	99.96%	100.00%	99.52%	99.81%	99.96%	100.00%

[1] All Weather Conditions: all ceiling and visibility conditions

[2] IFR Weather Conditions: ceiling less than 1,000 feet and below three statue miles but greater than or equal to 200 feet and one statute mile

Source: National Climatic Data Center – Burlington International Airport 2008-2017 (726,170)

According to the runway wind analysis, the current combined runway alignment at the Airport provides the recommended 95 percent coverage. The RDC of C-IV-2400 coverage is shown by the 20-knot coverage percentages as smaller aircraft cannot withstand as strong crosswinds. The 20-knot crosswind coverage allows operations at the Airport 100 percent of the time. In all weather conditions, Runway 15-33 does not provide the required 95 percent wind coverage for 10.5-knot crosswinds (it provides only 92.88 percent coverage). Therefore Runway 1-19 is justified as a crosswind A/B-I(S) runway and eligible for FAA funding.

Recommendation: Wind coverage meets 95 percent for both runways in both all-weather and IFR conditions. There is no recommendation for change.

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 standards for RSAs surrounding runways serving C-IV aircraft (Runway 15-33) 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. RSAs for runways serving A/B-I(S) aircraft (Runway 1-19) with a visibility minimum of 1 mile, the most demanding for an approach to Runway 1-19, include a width of 120 feet and 240 feet beyond the departure end and prior to the threshold. Both runways have published declared distances, as shown in **Table 5-4.** Portions of the RSAs extend beyond airport property and/or have non-standard grading as shown in **Figure 5-1.** Existing published declared distances indicate Runway 33 has 8,320 feet available while published runway length is only 8,319 feet. Similarly, Runway 1-19 declared distances also have a one-foot difference between published runway distance and published declared distances.

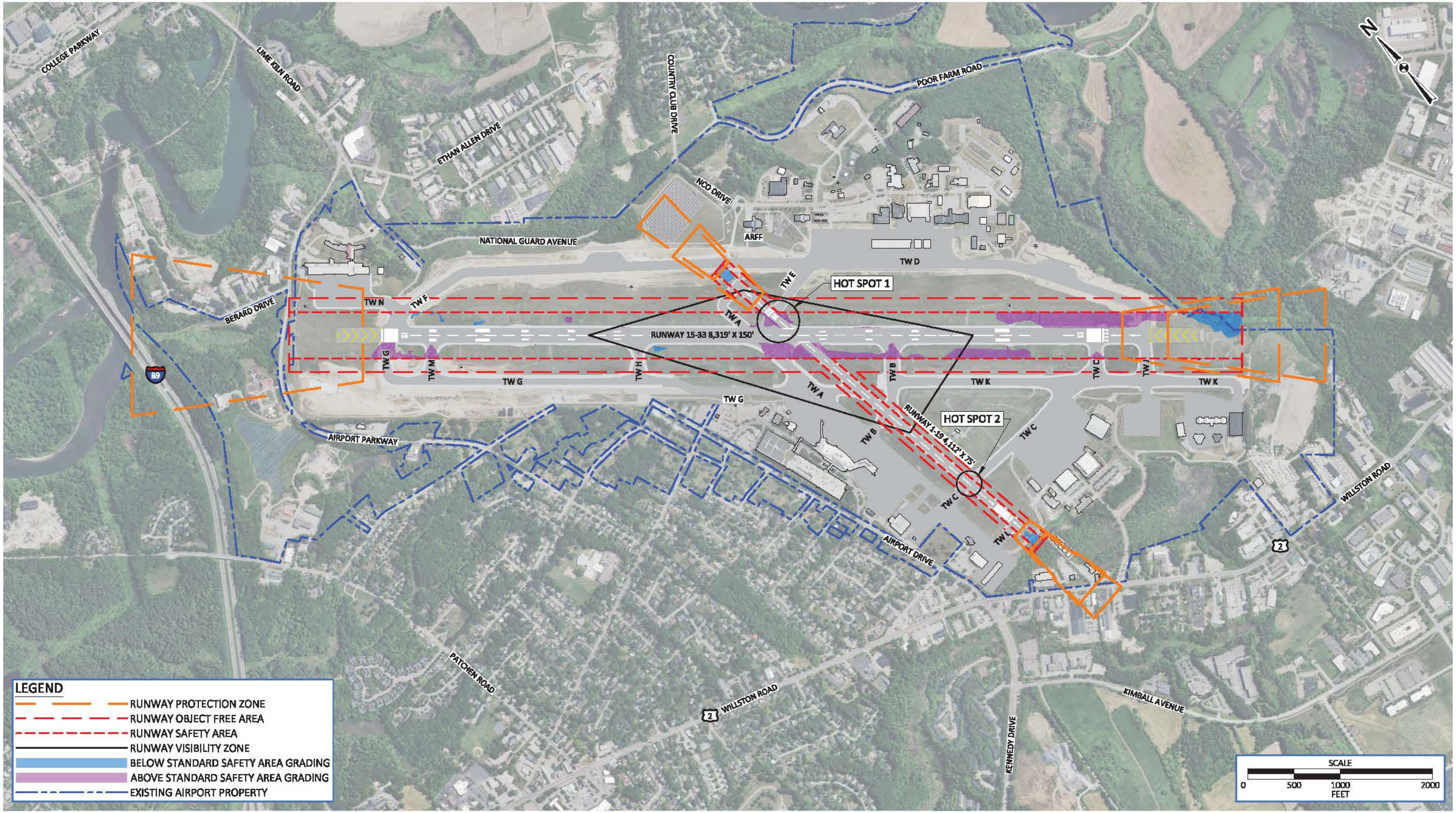
Table 5-4: Declared Distances

Runway	15-33	1-19
Takeoff Run Available (TORA)	7,820’ / 8,320’	3,611’ / 4,111’
Takeoff Distance Available (TODA)	7,820’ / 8,320’	3,611’ / 4,111’
Accelerate-Stop Distance Available (ASDA)	7,820’ / 8,320’	3,611’ / 4,111’
Landing Distance Available (LDA)	7,820’ / 7,820’	3,386’ / 3,386’

Source: Federal Aviation Administration (FAA) 5010-1, effective 10-11-2018

Recommendation: RSAs should be on airport property and meet grading standards whenever possible.

Figure 5-1: Burlington International Airport Safety Areas



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 RSA, there is no physical component to the ROFA. Thus, there is no requirement to support an aircraft or emergency response vehicles.

FAA design standards for ROFAs surrounding runways serving RDC C-IV-2400 (Runway 15-33) aircraft are a width of 800 feet, a length that extends 600 feet prior to the landing threshold, and a length that extends 1,000 feet beyond the runway end. Runways serving RDC A/B-I(S)-5000 (Runway 1-19) with a visibility minimum of 1 mile, the most demanding for an approach to Runway 1-19 have a width of 250 feet and protect 240 feet beyond the runway end and prior to the threshold. Portions of the Runway 15-33 ROFA extend beyond Airport property.

Recommendation: ROFA areas extending beyond Airport property should be acquired in easement or fee.

5.2.8 Runway Protection Zones

RPZs are large 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 are dependent 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. Many land uses (i.e. residential, places of public assembly, fuel storage) are prohibited by FAA guidelines within these areas. However, these limitations are only enforceable if the RPZ is owned or controlled by the Airport sponsor. 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 dimensions of the RPZ for each runway end are a function of the type of aircraft and the approach visibility minimums associated with operations on that runway. The RPZ begins 200 feet beyond the end of the area usable for takeoff and landing for all runways. The existing approach visibility minimums are shown in **Table 5-5**.

Table 5-5: RPZ Dimensions Per Runway End

Runway	Minimums	Length	Inner Width	Outer Width	Acreage
Runway 15	2,400’	2,500’	1,000’	1,750’	78.914
Runway 33	5,000’	1,700’	500’	1,010’	29.465
Runway 1	1 mile	1,000’	250’	450’	8.035
Runway 19	VIS	1,000’	250’	450’	8.035

Source: FAA published approach plates effective Jan. 2, 2019 – Jan. 31, 2019 and FAA AC 150/5300-13A

FAA Memorandum *Interim Guidance on Land Uses Within a Runway Protection Zone* dated September 27, 2012 notes that the following land uses at BTV require coordination with APP-400 (FAA’s Airport Planning and Environmental Division at headquarters) who will coordinate with AAS-100 (Airport Engineering Division) should RPZ sizes or locations change:

- Buildings and structures (including commercial/industrial buildings)
- Transportation facilities (including public roads/highways)
- Above-ground utility infrastructure, including any type of solar panel installations

"This interim policy only addresses the introduction of new or modified land uses to an RPZ and proposed changes to the RPZ size or location." The current FAA guidance does not require relocation of existing roadways within RPZs unless a change in geometry of the runway, a roadway, or an RPZ size occurs.

The Runway 15 approach RPZ extends beyond Airport property and over Airport Parkway, Berard Drive, and Interstate 89. Additionally, there are public buildings located within this RPZ. The Runway 33 approach and Runway 15 departure RPZs extend beyond Airport property. Currently, there are no non-standard uses within those RPZs.

Both the Runway 19 arrival and Runway 1 departure RPZs are located on airport property. Runway 19 approach RPZ is clear of non-standard uses. Runway 1 departure RPZ includes a solar facility. Runway 1 approach and 19 departure RPZs extend beyond airport property and over Williston Road and commercial buildings.

Recommendation: Acquire control of all land uses within existing RPZs (through fee simple acquisition or avigation easements) for those properties not currently under Airport control or owned by a public entity.

5.2.9 Runway Visibility Zone

Standards have been developed for pilot visibility along runways, and between intersecting runways, which are known as the runway visibility zone (RVZ). The RVZ is an area formed by imaginary lines connecting the two runways' line of sight points, which are typically located half of the length between each runway end and the runway intersection unless, the runway intersection is located less than 1,500 feet from the end of the runway. This is the case for Runway 19. The current standard for intersecting runways recommends a clear line of sight between the ends of intersecting runways. According to FAA AC 150/5300-13A*,* terrain needs to be graded and permanent objects need to be designed or sited so that there will be an unobstructed line of sight from any point five feet above one runway centerline to any point five feet above an intersecting centerline, within the RVZ. These standards are currently met at BTV.

Recommendation: No improvements to the existing RVZ are recommended.

5.2.10 Runway Pavement Markings

Both ends of primary Runway 15-33 have precision instrument approach runway markings. Runway 1 has non-precision instrument runway markings and Runway 19 has basic/visual markings. There are no plans nor recommendations for establishing a precision approach to either end of Runway 1-19. Consequently, the runway markings at the Airport are appropriate for their current and future approach requirements respectively.

Recommendation: No improvements to the existing runway pavement markings are required.

5.2.11 Taxiways

There are currently 13 taxiways at the Airport. Runway 1-19 is served by a full parallel taxiway. Runway 15-33 is served by partial parallel Taxiways K and G. A project to connect the two taxiways together and form a full-length parallel taxiway is in its final phase.

Planning standards for taxiways include taxiway width, taxiway safety areas, taxiway object free areas, taxiway shoulders, and for parallel taxiways, the distance between the runway and taxiway centerlines. The dimensions of each standard vary based on the identified airplane design group (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, as well as the width of the main gear. There are six ADG groups, and seven TDG groups. Details regarding the various dimensions follow in **Table 5-6** and **Table 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*	400	400	400	500*

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

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 AC 150/5300-13A

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. 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.

The future design aircraft (B757) for Runway 15-33 is TDG 4 aircraft. Certain taxiways will only be used by A/B-I small aircraft; these taxiways will be designed to meet TDG 1A standards.

Taxiway A is a partial-length parallel taxiway for Runway 1-19. It connects Taxiway C and the terminal apron to Runway 19. Taxiway A is 75 feet wide and 300 feet from the Runway 1-19 centerline, which both meet FAA standards. Currently, the Airport has a modification to standards for the taxiway to fixed or moveable object/movement area line.

Taxiway B is a connector taxiway between Taxiway A, crossing Runway 1-19 to Runway 15-33. The taxiway width varies between 75 and 130 feet, which meets FAA standards. It intersects Runway 1-19 at a non-standard 42-degree angle to the primary Runway 15-33.

Taxiway C is a crossover taxiway between the general aviation (GA) parking apron and Runway 15-33, crossing Runway 1-19 and Taxiway K. The taxiway width varies between 93 and 117 feet, which meets FAA standards.

Taxiway D is closed to civilian operations.

Taxiway E is the primary taxiway for military non-fighter aircraft on arrival/departure to the Air National Guard apron. Taxiway E is closed to civilian operations.

Taxiway F is closed to civilian operations.

Taxiway G is a partial-length parallel taxiway connecting the Runway 15 threshold to Runway 1-19. Recently reconstructed, Taxiway G from Runway 15 to Taxiway H, is offset 500 feet from the runway centerline. The remainder of Taxiway G, from Taxiway H to Runway 1-19 is offset at 600 feet from the runway centerline. During the Taxiway G Phase 2 project, which will connect Taxiway G between Taxiway H and Taxiway K, the taxiway will be constructed at a 500-foot separation, which meets FAA design standards.

Taxiway H is an entrance/exit taxiway to Runway 15-33 north of Runway 1-19. It is 83 feet wide, which meets FAA standards.

Taxiway J is an entrance/exit taxiway at the Runway 33 runway end and is 116 feet wide, which meets FAA standards.

Taxiway K is a partial-length parallel taxiway to Runway 15-33 between Taxiway B and past Taxiway J to the southern-most GA parking apron. The taxiway width varies between 75 and 80 feet and it is located 500 feet from the Runway 15-33 centerline, which meets FAA standards.

Taxiway L is closed to aircraft over 60,000 pounds. It is an entrance/exit taxiway located at the Runway 1 threshold. Taxiway L is 75 feet wide, which meets FAA standards.

Taxiway M is a seasonal taxiway. It is an exit/entrance taxiway near the Runway 15 threshold and is 89 feet wide which meets FAA standards.

Taxiway N is closed to civilian operations.

Recommendation: There are no recommendations for design criteria. Any pavement condition in failed, serious, very poor, and poor condition should be rehabilitated in the short-term. Pavement assessed as fair should be rehabilitated within the planning period.

If any changes to the taxiways occur, Engineering Brief No. 89, *Taxiway Nomenclature Convention*, dated March 29, 2012 should be used to ensure clear taxiway nomenclature.

5.3 Passenger Terminal Facility Requirements

This section summarizes the methodology, assumptions, and general planning-level factors used to analyze facility requirements for key functional areas of the BTV passenger terminal. Requirements were analyzed based on a multitude of factors. The primary tool for the analysis was derived from ACRP

Report 25, *Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide (Model)*. Additionally, guidelines published in the following publications were included: International Air Transport Association's (IATA) *Airport Development Reference Manual (ADRM, 10th Edition)*; FAA AC 150/5360-13A, *Airport Terminal Planning*; and FAA AC 150/5300-13A, *Airport Design*.

5.3.1 Existing Passenger Terminal

As discussed in Chapter 2, Section 2.7.5.1 of this report, the passenger terminal is a two-level building with a north and south concourse totaling approximately 139,600 square feet (SF). The terminal houses core terminal functional areas as well as additional support areas. The core terminal functional areas are those related to the movement of passengers through the airport to and from departing and arriving aircraft and includes terminal curb length, airport and airline administrative offices, check-in and ticketing, outbound baggage screening and make-up areas, passenger security checkpoints, passenger holdrooms, concourse gates, inbound baggage handling, and concessions. These areas are supported by additional public use (restrooms, circulation, etc.) and administrative areas that fill the remainder of the terminal footprint. **Figure 5-2 and Figure 5-3**show the existing terminal space by current use and functional area for the first and second floor, respectively. **Table 5-8** summarizes the existing space of the terminal building by functional area. As shown in the table, core terminal functional areas are only allocated approximately 49 percent of available terminal space.

Figure 5-2: Terminal by Functional Area (First Floor)

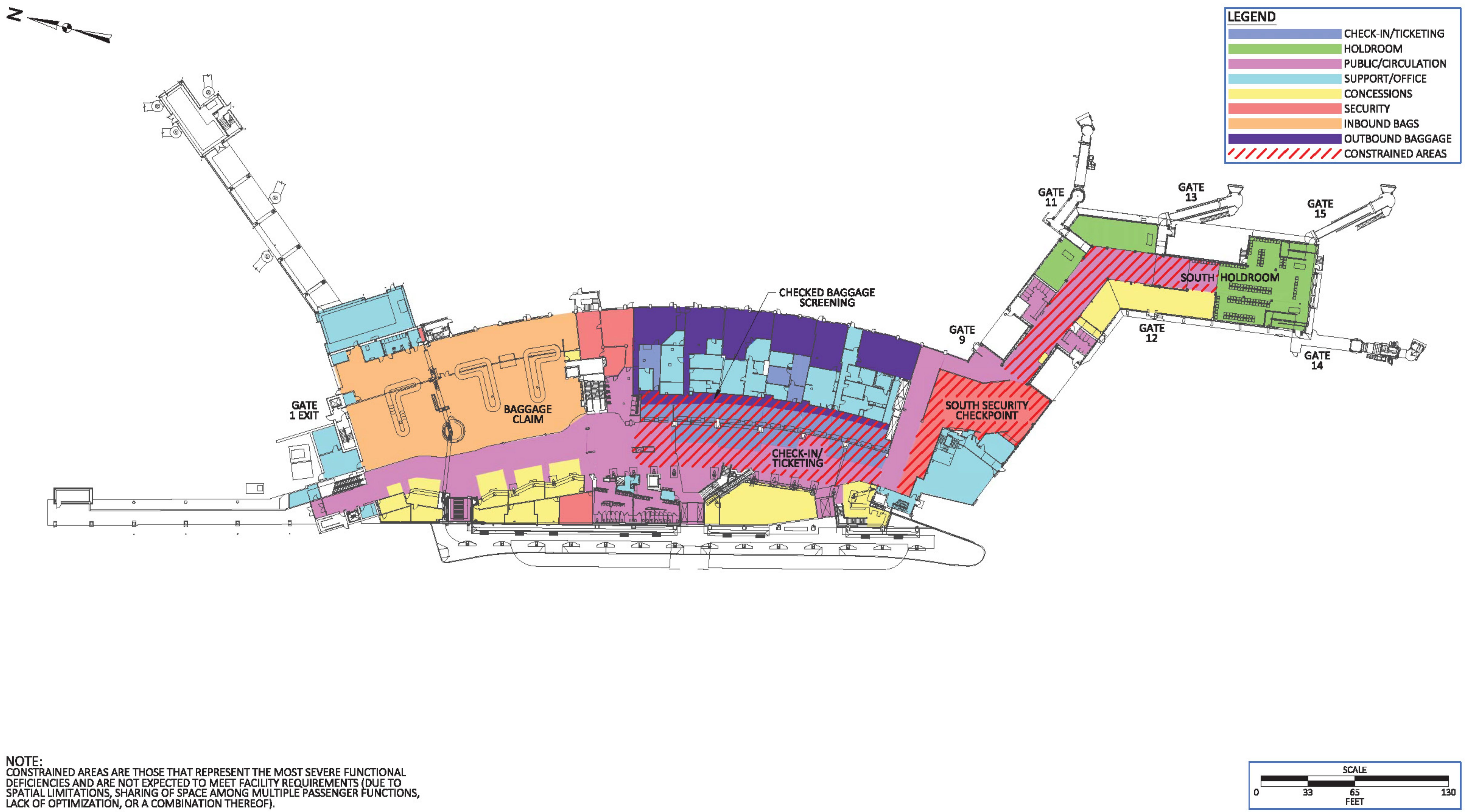
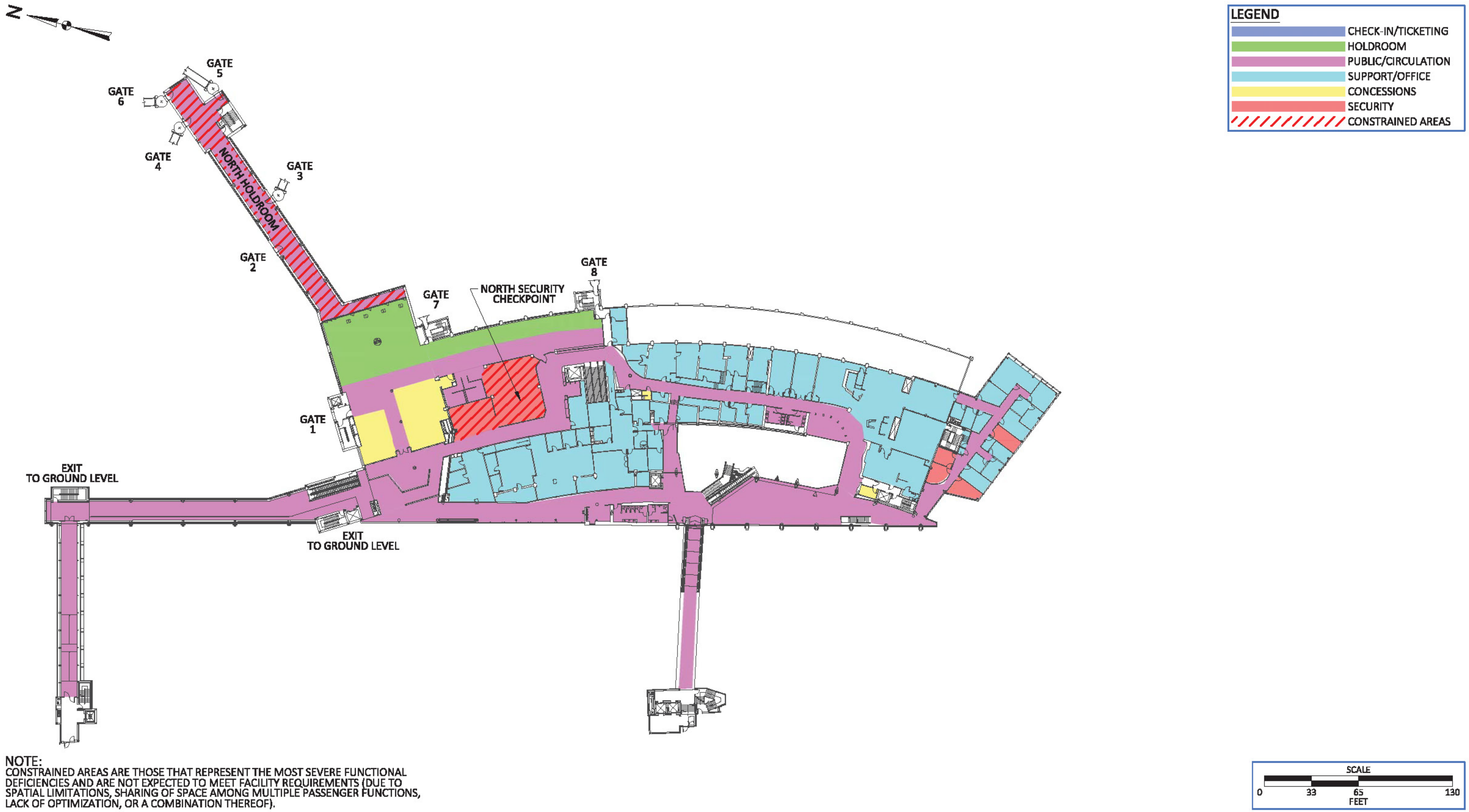


Figure 5-3: Terminal by Functional Area (Second Floor)



NOTE:
CONSTRAINED AREAS ARE THOSE THAT REPRESENT THE MOST SEVERE FUNCTIONAL DEFICIENCIES AND ARE NOT EXPECTED TO MEET FACILITY REQUIREMENTS (DUE TO SPATIAL LIMITATIONS, SHARING OF SPACE AMONG MULTIPLE PASSENGER FUNCTIONS, LACK OF OPTIMIZATION, OR A COMBINATION THEREOF).

Table 5-8: Existing Passenger Terminal Functional Areas

Terminal Functional Area	Existing Terminal Area (SF)
Passenger Boarding Gates	10
Terminal Curb / Drop-Off/Pick-Up (linear feet (LF))	620
Check-In / Ticketing (SF)	7,460
Outbound Baggage Screening & Makeup (SF)	7,126
Passenger Security Screening Checkpoint (SF)	
North Checkpoint	2,228
South Checkpoint	3,486
TSA Support Space	2753
Security Total	8,467
Passenger Lounges / Holdrooms (SF)	
North Holdrooms	11,294
South Holdrooms	11,421
Holdroom Total	22,715
Baggage Claim and Inbound Baggage Handling	12,656
Concessions	10,140
Core Terminal Areas Subtotal	**68,813 SF**
Other Functions/Tenants	70,787 SF
Total Passenger Terminal	**139,600 SF**

Note: SF = square foot
Source: Burlington Airport Commission, Terminal Drawings, Revised March 28, 2013

5.3.1.1 Methodology

Using the ACRP Model and FAA and industry standards guidance, the following passenger processing functions were examined using a derivative terminal planning model (the Model):

- Terminal Curb Length
- Passenger Check-In and Ticketing
- Outbound Baggage Screening and Make-Up
- Passenger Security Screening Checkpoint
- Passenger Lounges/Holdrooms
- Concourse Gates, Passenger Boarding Bridges and Terminal Apron
- Inbound Baggage Handling and Baggage Claim
- Concessions
- Other Terminal Support Functions

This analysis estimates the optimal space requirements of the terminal building by functional area. Based on the comparison between existing facility space and estimated requirements, recommendations for the planning period are given by functional area.

The terminal building analysis was performed using the baseline scenario. This scenario uses the forecasts presented in Chapter 3 of this report to determine future facility space requirements. Supplementing the baseline scenario, five additional modelling scenarios were analyzed, including the following:

- Addition of New Ultra Low Cost Carrier (ULCC)
- Addition of New Low Cost Carrier (LCC)
- Influence of Canadian dollar

- Loss of Low Cost Carrier
- Upgauging (of existing fleet)

The five additional planning scenarios impact forecasted enplanements and/or operations and the associated terminal spatial requirements at the Airport. Existing demand for the five additional planning scenarios was not estimated as none were realized at the time of modelling. Application of the Model under these scenarios, including the Baseline Scenario, is presented in the following sections.

5.3.1.2 Application of Terminal Planning Model

The Model is designed to determine terminal requirements by functional area based on historical and forecasted annual enplanements, departures, and gates. This model has been adapted from the ACRP Model to allow more dynamic inputs into the model to provide direct consideration for items that have become relevant since the creation of the ACRP in 2010. 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 a "top down" analysis, starting with annual demand to estimate peak activity demand. It is noted that peak hour demand in Chapter 3 covers a 90-minute period, whereas this model adjusts peak hour demand to account for activity within a 60-minute period.

Terminal facility requirements at BTV were determined using the assumptions shown in **Table 5-9** for peak hour enplanements, which corresponds to the baseline forecast assessment presented in Chapter 3 of this report, and the five additional planning scenarios previously defined.

Table 5-9: Peak Hour Enplaned Passengers by Scenario[1]

Scenario	2018	2023	2028	2038
Baseline	534	557	580	630
New ULCC	-	607	646	727
New LCC	-	653	707	817
Canadian	-	584	638	756
Loss of LCC	-	529	580	630
Upgauging	-	597	660	790

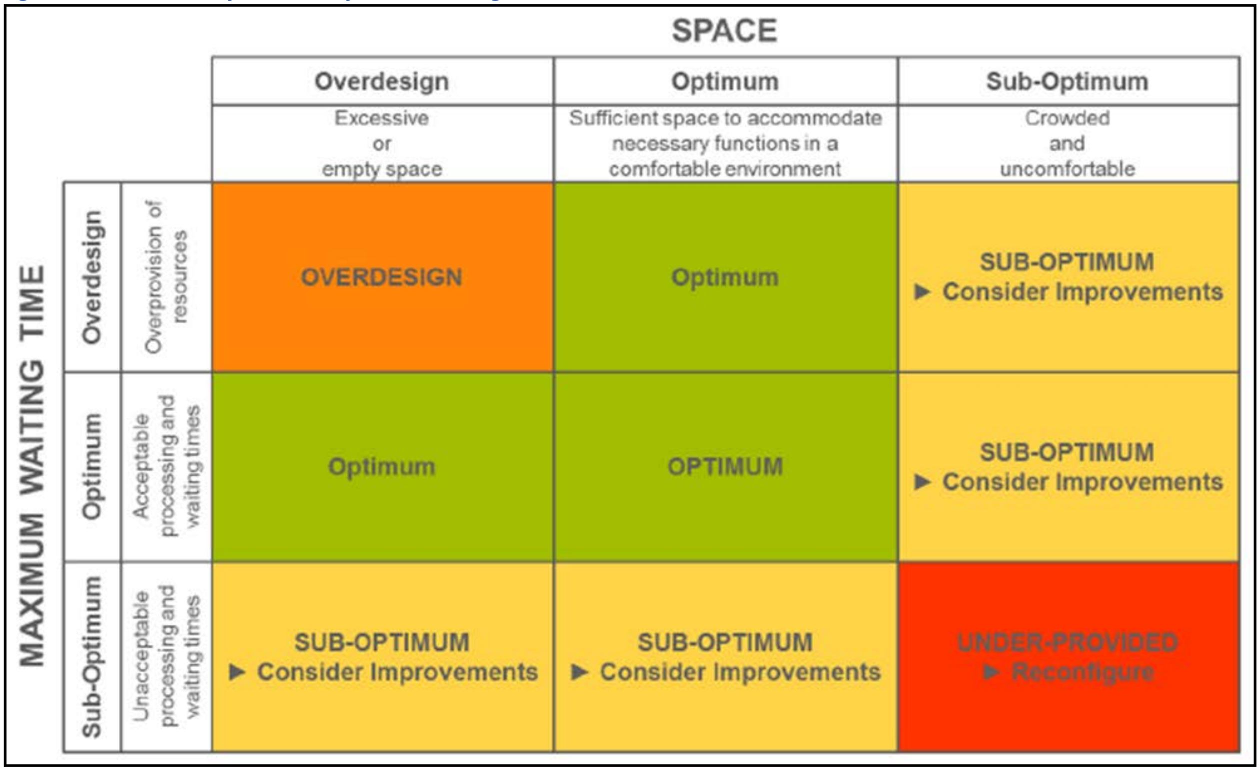
[1]Peak Hour Enplaned Passengers over a 60-minute period.
Source: CHA Analysis, 2018. McFarland Johnson Analysis, 2019

5.3.1.3 Level of Service (LOS) Standards

The IATA has published a comprehensive guide with standards for planning various passenger processing functions for airport terminal buildings. These standards reflect the dynamic nature of terminal operations and throughput (passenger processing rate from check-in through enplanement) and have the goal of increasing infrastructure efficiency. The Airport Development Reference Manual (ADRM) sets forth two variables, which jointly dictate a Level of Service (LOS); LOS includes space available and maximum waiting time. This space-time concept is the LOS framework for measuring the performance of passenger processing through each functional area of an airport terminal building and corresponding waiting areas. The measurement yields an indication of existing performance within four categories: under-provided, sub-optimum, optimum, and over-design.

Figure 5-4 illustrates how the space-time concept of LOS performance in airport terminals is evaluated. The space axis defines the amount of space available per occupant, and the time axis denotes the maximum waiting time for passengers in the queue. The objective of the space-time concept in ADRM is the provision of optimum passenger facilities and the avoidance of both over- or under-providing for passengers and the airport, airline, regulatory, or tenant staff doing the work of processing arriving and departing passengers to and from aircraft. As such, the majority of inputs into the Model are based on metrics related to optimum LOS.

Figure 5-4: IATA Level of Service Performance Categories



Source: IATA and Airports Council International (ACI), 2014

5.3.2 Assumptions

This section summarizes the assumptions utilized for the modelling each functional area of the terminal building facility requirements used throughout.

5.3.2.1 Percentage of Origin and Destination Passengers

For purposes of analyzing passenger terminal space requirements, it is assumed that 100 percent of enplaned passengers are origin and destination passengers at BTV. The originating passenger percentage is used to determine the number of passengers to be processed through check-in/ticketing and security screening, along with associated demands on outbound baggage functions, holdroom usage, and gate/boarding area egress.

5.3.2.2 Terminal Curb Length

Terminal curb length modelling is largely based on vehicle demand at the curb. Error! Reference source not found. illustrates the total peak hour vehicles at the curb and the peak 15-minute demand by scenario throughout the planning period. Curb peaking characteristics are a function of the following assumptions:

- Approximately 43 percent of departing passengers use parking facilities
- 1.5 passengers per parked vehicle
- Assumptions by vehicle type
- 35 percent of peak hour demand is realized during the peak 15-minute period

Assumptions by vehicle type include everything from private automobiles carrying one to three passengers to tour buses carrying large groups of passengers. For this analysis, a focus was placed on private autos, taxis/transportation network companies (TNC), limousine/executive cars, hotel shuttles, airport shuttles, and busses. Error! Reference source not found. displays the assumptions for passengers and dwell time by vehicle type that were used for all modelled scenarios throughout the planning period.

Table 5-10: Vehicle Peaking Assumptions

Scenario	2018	2023	2028	2038
Baseline				
Peak Hour Vehicles at Curb	120	125	128	137
Peak 15-Mins. Vehicles at Curb	42	44	45	48
New ULCC				
Peak Hour Vehicles at Curb	-	136	143	158
Peak 15-Mins. Vehicles at Curb	-	48	50	55
New LCC				
Peak Hour Vehicles at Curb	-	147	156	178
Peak 15-Mins. Vehicles at Curb	-	51	55	62
Canadian				
Peak Hour Vehicles at Curb	-	131	141	165
Peak 15-Mins. Vehicles at Curb	-	46	49	58
Loss of LCC				
Peak Hour Vehicles at Curb	-	119	128	137
Peak 15-Mins. Vehicles at Curb	-	42	45	48
Upgauging				
Peak Hour Vehicles at Curb	-	134	146	172
Peak 15-Mins. Vehicles at Curb	-	47	51	60

Source: McFarland Johnson Analysis, 2019

Table 5-11: Passengers per Vehicle and Dwell Time Assumptions

Vehicle Type	PAX per Vehicle	Dwell Time (Min.)
Private Auto	1.5	4.0
Taxi and TNC	1.5	3.0
Limousine/Executive Car	1.0	5.0
Hotel Shuttle	4.0	6.0
Airport Shuttle	4.0	6.0
Bus	5.0	7.0

Note: PAX = passengers; Min. = minutes
Source: BTV Airport, McFarland Johnson Analysis, 2019

5.3.2.3 Passenger Check-in /Ticketing

Passenger check-in/ticketing includes the functions of full-service staffed airline counter positions, self-service kiosks with ticketing and bag checking capabilities, self-serve kiosks with ticketing only, active check-in area, passenger queue area, airline ticket office areas, circulation area, and public restrooms accessible from the ticketing lobby. It is assumed that 60 percent of peak hour passengers are experienced in the peak 30-minute period. Space allocations recommended by ACRP guidance was used for counter, kiosk, active check-in, and queuing area assumptions. Additional assumptions regarding the use of facilities by passengers for these areas are shown in **Table 5-12**. As shown, the check-in patterns for passengers are expected to change over the planning period. The percent use of full service, staffed airline ticket office counters is expected to decrease as the convenience and appeal of self-service kiosks and mobile check-in among airport users grows with technological advances. Together, these assumptions were applied to the individual peaking characteristics of each scenario to determine the estimated space requirements for check-in/ticketing facilities.

Table 5-12: Passenger Check-in Percent Use by Facility Type

Assumption	2018	2023	2028	2038
Passengers Using Full Service ATO (Ticketing + Baggage)	60%	58%	55%	50%
Passengers Using Kiosks with Ticketing & Baggage Drop*	0%	0%	0%	0%
Passengers Using Kiosks with Ticketing Only	30%	30%	33%	35%
Passengers Using Curbside Check-in*	0%	0%	0%	0%
Passengers Using Mobile Check-in with no Checked Bags	10%	12%	12%	15%

*Note: * Check-in type is not available at BTV and is not expected to be over the planning period*
Source: McFarland Johnson Analysis, 2019

5.3.2.4 Outbound Baggage Make-Up and Screening

Outbound baggage screening and make-up functions includes operations by Transportation Security Administration (TSA) to screen checked baggage and airline staff to collect and disperse bags to carts and the appropriate aircraft prior to departure. Outbound baggage volume assumptions shown in **Table 5-3** were applied to all scenarios throughout the planning period based on airport-specific data provided by the TSA.

Table 5-13: Outbound baggage and Screening Systems Assumptions

Item for Analysis	Assumption
Peak Hour Passengers Checking Bags*	54 Percent
Checked Bags per Passenger	1 Bag
Bag Size – Standard	95 Percent
Bag Size – Oversized	5 Percent

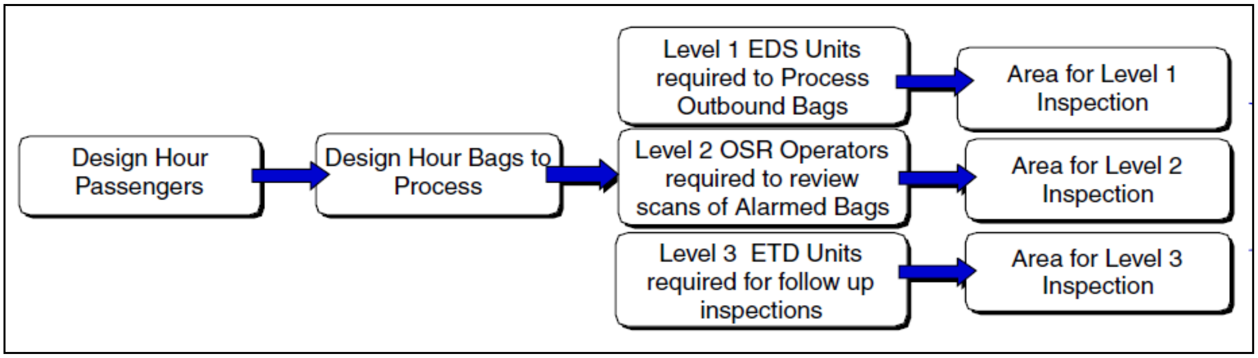
*Note: *Number of checked bags remains constant over the period, should the trend of reduced checked baggage not continue*
Source: McFarland Johnson Analysis, 2019

The general modelling framework for TSA baggage screening is shown in Figure 5-5. Checked baggage is sent through a series of screening levels based on triggered alarms. The estimated alarm rates for each level determine the need for level-specific equipment, which yields associated space requirements. 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 150 bags per hour, with an alarm rate of 22 percent. Level 2 OSR processing ration was set at 80 bags per hour, with an OSR clearing rate of 43 percent. For Level 3 ETD screening, the TSA suggests 24 bags per hour per operator. Baggage screening space requirements contained in the Model were utilized here, and 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 station

An additional 35 percent of space is added for circulation area, and 15 percent to allow for future equipment changes and any required reconfiguration or renovations.

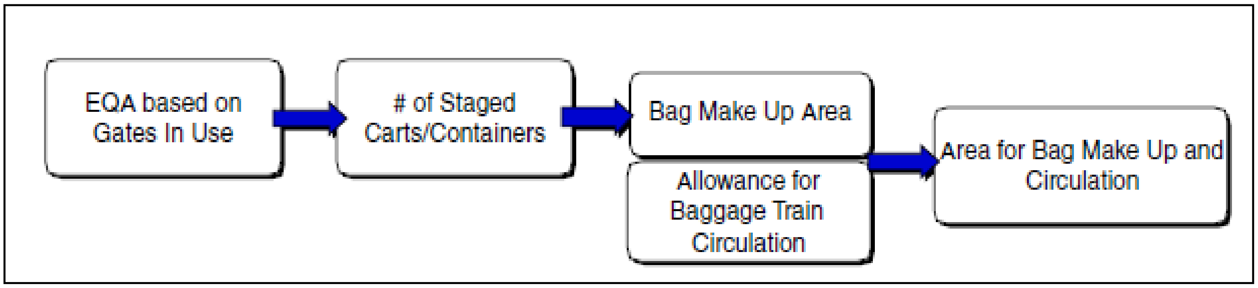
Figure 5-5: TSA Baggage Screening Model Framework



Note: EDS = explosive detection system; OSR = on-screen resolution; ETD = explosive trace detection
Source: ACRP Report 25, Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide (Model)

Figure 5-6 displays the general modelling approach for baggage make-up areas. Baggage make-up is largely based on the equivalent aircraft (EQA), which is metric commonly used to normalize each gate capacity based on the seating capacity of the aircraft that can be accommodated. The Model assumes approximately two to three departures per peak hour across the planning period and the resulting volume of checked baggage can be accommodated utilizing four to six baggage carts. The Model suggests that each cart requires 600 SF of space. An additional 20 percent of square footage is included for baggage train circulation and 15 percent for mechanical and support space.

Figure 5-6: Baggage Make-Up Area Model Framework



Note: EQA = equivalent aircraft
Source: ACRP Report 25, Airport Passenger Terminal Planning and Design, Volume 2: Spreadsheet Models and User's Guide (Model)

5.3.2.5 Passenger Security Screening Checkpoint

This section discusses the assumptions utilized to analyze the future demand for security screening of departing passengers. The existing passenger security screening is configured into separate north and south checkpoints, with both operating a two-to-one equipment configuration (two screening lanes with carry-on x-ray to one set of body scanning equipment). It is noted that these configurations are constrained and do not provide adequate divestment length prior to screening in most cases, which is known to reduce throughput. As a result, the space requirements for the continued use of separate checkpoints as well as those for one centralized security checkpoint were modelled for comparison.

The following assumptions remained consistent among both modelling configurations (separate and centralized) throughout each planning scenario:

- Two-to-one lane configuration for normal lanes with two lanes per one advanced imaging technology (AIT) and walk through metal detector (WTMD) equipment layout.
- Space required per two-to-one: 1,600 SF not including allowance for future equipment movements or changes.
- The percentage assumed for non-passenger traffic, such as employees and crew, is five percent, which was added to the design peak hour passenger screening demand.
- One-to-one lane configuration for TSA PreCheck lanes with 10 percent of screened passengers use TSA PreCheck.

Under a separate configuration, it was estimated that approximately 63 percent of passengers use the north checkpoint and the remaining 37 percent are screened at the south checkpoint based on TSA metrics. Passenger throughput was estimated to be 146 and 180 passengers/hour at the north and south checkpoints, respectively. Under a centralized configuration, it is estimated that throughput can reach 185 passengers/hour over the planning period as the efficiencies of a centralized screening facility are realized. As with other functional areas, allowances were also included for future equipment changes (10 percent) or reconfigurations and TSA support space (8 percent).

5.3.2.6 Concourse Gates and Passenger Boarding Bridges

To determine the required number of concourse gates, and subsequently passenger boarding bridges, the model employs a departure per gate approach which assumes three daily departures per gate throughout the planning period for all scenarios.

5.3.2.7 Passenger Lounges/Holdrooms

Holdroom space typically accounts for seating a certain percentage of passengers, with the remaining passengers either not in the holdroom area or standing. The amount of holdroom space needed is generally based on the size of the aircraft gate positions available, which is measured in EQAs. For this analysis, it was assumed that 85 percent of passengers per EQA are in the holdroom area, of which 80 percent are seated. The analysis assumed 15 SF per seated passenger and 10 SF per standing passenger. The Model also includes some flexibility to account for amenities (e.g., children’s play area, telephones, work areas, charging stations, etc.), and high utilization and holdroom sharing, when the holdroom is utilized for passengers waiting for more than one flight or is shared between gates.

The model recommends approximately 115 SF to accommodate a single-position airline gate podium and agents, as well as 240 SF for boarding corridor space per gate. Both are added to holdroom space requirements in the analysis. Allowances for amenities, circulation, and restrooms are assumed to be 5 percent, 35 percent, and 15 percent, respectively.

5.3.2.8 Inbound Baggage Handling & Baggage Claim

Inbound baggage handling includes the unloading of baggage from aircraft and transferring them to the baggage claim unit for circulation to the baggage claim hall. The model calculates baggage claim requirements assuming that a percentage of passengers will deplane in a peak 20-minute period. For

BTV, it is assumed that 100 percent of passengers terminate at the Airport. As previously noted, it is also assumed that 54 percent of passengers will check one bag. Additionally, the following assumptions are made:

- An additional 10 percent is added to the number of passengers checking bags to account for individuals in the area not retrieving bags.
- Three linear feet of claim is required for each person in the claim lobby.
- Typical carousel unit frontage at BTV is 112 linear feet.
- 15 SF per person in the baggage claim lobby is required to provide for adequate queuing, bag retrieval, and circulation space.
- Baggage claim area is increased by 15 percent to provide for baggage services office.
- Baggage claim area is increased by 15 percent to provide for meet and greet area.
- Baggage claim area is increased by 20 percent to provide for circulation space.
- Baggage claim area is increased by 10 percent to provide for restroom facilities.

To account for inbound baggage handling area the following assumptions are made:

- Take off belts require 850 SF of space each.
- An additional 30 percent allowance is included for baggage train circulation.
- An additional 20 percent allowance is included for conveyor belts equipment and other miscellaneous equipment.

5.3.2.9 Concessions

Terminal concessions include both non-secure and secure area retail establishments to service departing and arriving passengers. For this assessment, it is assumed that 30 percent of peak hour passengers will use pre-secure concessions and 70 percent of peak hour passengers will use post-secure area concessions. The model makes the following assumptions to calculate spatial requirements:

- Food and beverage-based concessions require seven SF per peak hour passenger.
- Retail based concessions requires 3.5 SF per peak hour passenger.
- Service based concessions require 0.5 SF per peak hour passenger.
- A multiplier of 30 percent is used to account for support space for food and beverage concessions.
- A multiplier of 20 percent is used to account for support space for retail concessions.
- Internal circulation area allowance of 15 percent is also included for terminal building concession areas.

5.3.2.10 Other Terminal Support Facilities

The final consideration of passenger terminal functional areas includes allowances for the following:

- Airline Operations: 10 percent of calculated departure/arrival areas
- Ground Handling Services: five percent of calculated departure/arrival areas
- Airport Operations and Maintenance: five percent of calculated departure/arrival areas
- Facilities Support and Services: five percent of calculated departure/arrival areas
- Building Structure Allowance: five percent of net departure/arrival/secure areas
- Vertical Circulation: five percent of net departure/arrival/secure areas
- Mechanical/Electrical/Utility: five percent of net departure/arrival/secure areas
- Allowance for Other Tenants/Configurations: four percent of total terminal area

5.3.3 Results of Analysis

The results of the analysis are summarized in **Table 5-14 (pages 169 and 171)** for the baseline forecast and **Table 5-15 (pages 173 and 175)** for forecast scenarios. Additional detail and recommendations provided in the subsequent sections. In general, the footprint of the terminal building has enough raw space between its two floors to accommodate demand throughout the planning period. However, the space is currently not optimized to provide space to the core terminal functional areas. Space restrictions in key areas, large amounts of unused space, and surpluses among nonessential space types yield expected deficits and strain among core terminal functional areas and facilities. As a result, it is recommended, and further detailed in this section, that space be reconfigured and repurposed to resolve such deficits and optimize the use of the terminal footprint to avoid costly expansion where possible.

5.3.3.1 Terminal Curb Length

With 620 linear feet (LF) of curb length currently available at the Airport, it is estimated that there is adequate terminal curb length throughout the planning period across all modelled scenarios.

Recommendation: There are no recommendations for the terminal curb.

5.3.3.2 Passenger Check-In/Ticketing

As shown in **Table 5-14**, the baseline scenario requires one additional full-service check-in ticket counter by 2028. This requirement is largely dependent of the adoption and increased use of self-service check-in kiosks by passengers. Should adoption grow at a higher rate than assumed, this additional position may not be necessary. Under the baseline conditions, the Airport has adequate kiosk facilities throughout the planning period. Despite the availability of check-in positions to meet the majority of demand, the associated space with these facilities is severely restricted. An 809 SF deficit in the check-in area is expected by 2038. Expected space deficits in this area are largely due to the sharing of circulation areas by several passenger groups within the check-in/ticketing hall. Circulation space within the hall is shared by passengers using check-in facilities, baggage claim and/or the exit, vertical circulation, and the concessions located within the hall. Flexibility within this area is also limited by the location of outbound baggage screening directly behind airline ticket counters.

The strain on these shared facilities will become more apparent as demand increases, as seen in the scenario modelling. Should the New LCC scenario be realized, which proposes the highest demand scenario, it is expected the check-in hall will have a space deficit of 3,013 SF. This strain may be offset by surpluses in airline ticketing office space, which are located directly behind the outbound baggage screening area. Airline ticketing offices total approximately 5,200 SF, which is approximately 3,600 SF more than required under the most demanding scenario (New LCC).

Recommendation: It is recommended that the check-in hall and adjacent facilities be reconfigured to allow greater space flexibility. Surpluses in airline ticketing offices may provide opportunity to relocate outbound baggage screening out of the ticketing space. This should be partnered with a redirection or additional space provision for arriving traffic from the south concourse as to avoid use of circulation space within the check-in to further optimize use of space.

Table 5-14: Baseline Terminal Functional Area Requirements

Functional Area	Existing Facility	Base Year 2018	Base +5 Years 2023	Base +10 Years 2028	Base +20 Years 2038	Surplus (Deficit)
Annual Enplanements	**591,558**	**667,004**	**695,171**	**724,825**	**787,012**	-
Peak Hour Enplanements[1]	**474**	**534**	**557**	**580**	**630**	-
Passenger Gates (Narrowbody Gate Equivalents)[2]	10	10	10	11	11	(1)
Curb Length	620 LF	230 LF	230 LF	238 LF	260 LF	360 LF
Check-In/Ticketing						
Staffed Counter Positions	16	18	18	17	17	(1)
Kiosk Positions	14	6	6	7	8	6
Check-In Ticket Area (Counter/Kiosk/Active/Queue)	3,865 SF	3,937 SF	3,971 SF	3,974 SF	4,102 SF	(237 SF)
Check-In and Ticketing Circulation Area[3]	2,790 SF	1,322 SF / 3,304 SF	1,330 SF / 3,326 SF	1,312 SF / 3,281 SF	1,344 SF / 3,360 SF	1,446 SF / (570 SF)
Restrooms	805 SF	793 SF	798 SF	787 SF	807 SF	(2 SF)
Check-in Ticketing Area Total	**7,460 SF**	**6,052 SF / 8,034 SF**	**6,100 SF / 8,095 SF**	**6,073 SF / 8,042 SF**	**6,253 SF / 8,269 SF**	**1,207 SF / (809 SF)**
Outbound Baggage Screening and Make-Up						
Level 1 EDS Screening Area	1,878 SF (shared)	2,400 SF	2,400 SF	2,400 SF	2,400 SF	(2,593 SF) (shared)
Level 2 OSR Screening Area	1,878 SF (shared)	40 SF	80 SF	80 SF	80 SF	(2,593 SF) (shared)
Level 3 ETD Screening Area	1,878 SF (shared)	300 SF	300 SF	300 SF	400 SF	(2,593 SF) (shared)
Equipment Area, Support Space, and Future Expansion Allowance	1,878 SF (shared)	1,514 SF	1,536 SF	1,536 SF	1,591 SF	(2,593 SF) (shared)
Make-Up Area (Including Baggage Train Circulation & Mech. Support Spaces)	5,248 SF	4,140 SF	4,140 SF	4,140 SF	4,140 SF	1,108 SF
Outbound Baggage Screening and Make-Up Area Total	**7,126 SF**	**8,394 SF**	**8,456 SF**	**8,456 SF**	**8,611 SF**	(1,485 SF)
Passenger Security Screening Checkpoint						
Screening Lanes (TSA PreCheck included)						
North Checkpoint	2	5	5	5	5	(3)
South Checkpoint	2	3	3	3	3	(1)
Total (Existing Configuration)	4	8	8	8	8	(4)
Total Centralized Facility	-	6	6	6	6	(2)
Checkpoint Area (Security Screening/Queue/Allowance for Equipment Changes)						
North Checkpoint	2,228 SF	7,035 SF	7,105 SF	7,180 SF	7,336 SF	(5,108)
South Checkpoint	3,486 SF	4,562 SF	4,604 SF	4,648 SF	4,740 SF	(1,254)
Total (Existing Configuration)	5,714 SF	11,597 SF	11,709 SF	11,828 SF	12,076 SF	(6,362)
Total Centralized Facility	-	9,810 SF	9,923 SF	10,041 SF	10,289 SF	(4,575)
TSA Support Space Area						
Total (Existing Configuration)	2,753 SF	928 SF	936 SF	946 SF	966 SF	1,787 SF
Total Centralized Facility	-	785 SF	794 SF	803 SF	823 SF	1,930 SF
Passenger Security Screening Checkpoint Total (Existing Configuration)	**8,467 SF**	**12,524 SF**	**12,646 SF**	**12,774 SF**	**13,042 SF**	**(4,575 SF)**

Functional Area	Existing Facility	Base Year 2018	Base +5 Years 2023	Base +10 Years 2028	Base +20 Years 2038	Surplus (Deficit)
Annual Enplanements	**591,558**	**667,004**	**695,171**	**724,825**	**787,012**	**-**
Peak Hour Enplanements[1]	**474**	**534**	**557**	**580**	**630**	**-**
Passenger Security Screening Checkpoint Centralized Facility Total	-	10,595 SF	10,716 SF	10,844 SF	11,112 SF	**(2,645 SF)**
Passenger Lounges/Holdrooms[4]						
North Side						
Holdroom Area (Seated/Standing/Ticketing/Boarding/Amenities)	6,124 SF	3,720 SF	3,799 SF	3,881 SF	4,054 SF	2,070 SF
Holdroom Circulation Area	4,738 SF	1,302 SF	1,329 SF	1,358 SF	1,419 SF	3,319 SF
Restrooms	432 SF	531 SF	543 SF	554 SF	579 SF	(147 SF)
North Side Area Total	**11,294 SF**	**5,553 SF**	**5,670 SF**	**5,794 SF**	**6,052 SF**	**5,242 SF**
South Side						
Holdroom Area (Seated/Standing/Ticketing/Boarding/Amenities)	4,174 SF	2,960 SF	3,006 SF	3,229 SF	3,314 SF	860 SF
Holdroom Circulation Area	6,563 SF	1,036 SF	1,052 SF	1,130 SF	1,160 SF	5,403 SF
Restrooms	684 SF	423 SF	429 SF	461 SF	473 SF	211 SF
South Side Area Total	**11,421 SF**	**4,418 SF**	**4,487 SF**	**4,820 SF**	**4,947 SF**	**6,474 SF**
Inbound Baggage Handling and Claim						
Baggage Claim						
Baggage Claim Frontage	249 LF	272 LF	284 LF	295 LF	321 LF	(72 LF)
Baggage Claim Unit Area	8,191 SF (shared)	2,500 SF	2,500 SF	2,500 SF	2,500 SF	2,178 SF (shared)
Passenger Queue & Bag Retrieval Area	8,191 SF (shared)	1,497 SF	1,559 SF	1,622 SF	1,764 SF	2,178 SF (shared)
Allowance for Meeters/Greeters	8,191 SF (shared)	600 SF	609 SF	618 SF	640 SF	2,178 SF (shared)
Baggage Claim Area Circulation	8,191 SF (shared)	1,039 SF	1,055 SF	1,072 SF	1,109 SF	2,178 SF (shared)
Baggage Service Office	-	600 SF	609 SF	618 SF	640 SF	(640 SF)
Restrooms	-	624 SF	633 SF	643 SF	665 SF	(665 SF)
Inbound Baggage Handling						
Take-Off Belt Area	4,465 SF (shared)	1,700 SF	1,700 SF	1,700 SF	1,700 SF	2,153 SF (shared)
Allowance for Baggage Train Circulation	4,465 SF (shared)	510 SF	510 SF	510 SF	510 SF	2,153 SF (shared)
Allowance for Conveyor Belt & Equip. Belts/Equipment	4,465 SF (shared)	102 SF	102 SF	102 SF	102 SF	2,153 SF (shared)
Inbound Baggage Handling and Claim Area Total	**12,905 SF**	**9,171 SF**	**9,278 SF**	**9,385 SF**	**9,630 SF**	**3,026 SF**
Concessions						
Pre-Secure Concession Area (Service/Support)	5,925 SF	3,302 SF	3,441 SF	3,588 SF	3,896 SF	2,029 SF
Post-Secure Concession Area (Service/Support)	4,215 SF	7,704 SF	8,029 SF	8,372 SF	9,090 SF	(4,875 SF)
Concessions Area Total	**10,140 SF**	**11,006 SF**	**11,470 SF**	**11,960 SF**	**12,986 SF**	**(2,846 SF)**
Core Terminal Areas Subtotal	**68,813 SF**	**57,118 SF / 59,100 SF**	**58,107 SF / 60,102 SF**	**59,262 SF / 61,231 SF**	**61,521 SF / 63,537 SF**	**7,043 SF / 5,027 SF**
Other Functions and Tenant Areas[5]	**70,787 SF**	**24,963 SF**	**25,429 SF**	**25,861 SF**	**26,923 SF**	**44,113 SF**
Total Terminal Building Area	**139,600 SF**	**82,081 SF / 84,063 SF**	**83,536 SF / 85,531 SF**	**85,123 SF / 87,092 SF**	**88,444 SF / 90,460 SF**	**51,156 SF / 49,140 SF**

Table 5-15: Scenarios Terminal Functional Area Ultimate Requirements

Functional Area	Existing Facility	New ULCC 2038	New LCC 2038	Canadian 2038	Loss of LCC 2038	Upgauging 2038
Annual Enplanements	**591,558**	**907,912**	**1,020,874**	**944,414**	**787,012**	**987,012**
Peak Hour Enplanements[1]	**474**	**727**	**817**	**756**	**630**	**790**
Passenger Gates (Narrowbody Gate Equivalents)[2]	10	11	12	11	11	11
Curb Length	620 LF	307 LF	260 LF	321 LF	260 LF	337 LF
Check-In/Ticketing						
Staffed Counter Positions	16	19	21	20	17	21
Kiosk Positions	14	9	10	10	8	10
Check-In Ticket Area (Counter/Kiosk/Active/Queue)	3,865 SF	4,657 SF	5,192 SF	4,891 SF	4,102 SF	5,108 SF
Check-In and Ticketing Circulation Area[3]	2,790 SF	1,521 SF / 3,801 SF	1,692 SF / 4,230 SF	1,598 SF / 3,994 SF	1,344 SF / 3,360 SF	1,671 SF / 4,177 SF
Restrooms	805 SF	912 SF	1,015 SF	959 SF	807 SF	1,002 SF
Check-in Ticketing Area Total	**7,460 SF**	**7,090 SF / 9,370 SF**	**7,899 SF / 10,437 SF**	**7,448 SF / 9,844 SF**	**6,253 SF / 8,269 SF**	**7,781 SF / 10,287 SF**
Outbound Baggage Screening and Make-Up						
Level 1 EDS Screening Area	1,878 SF (shared)	3,200 SF	3,200 SF	3,200 SF	2,400 SF	3,200 SF
Level 2 OSR Screening Area	1,878 SF (shared)	80 SF	80 SF	80 SF	80 SF	80 SF
Level 3 ETD Screening Area	1,878 SF (shared)	400 SF	400 SF	400 SF	400 SF	400 SF
Equipment Area, Support Space, and Future Expansion Allowance	1,878 SF (shared)	2,033 SF	2,033 SF	2,033 SF	1,591 SF	2,033 SF
Make-Up Area (Including Baggage Train Circulation & Mech. Support Spaces)	5,248 SF	4,140 SF	4,140 SF	4,140 SF	4,140 SF	4,140 SF
Outbound Baggage Screening and Make-Up Area Total	**7,126 SF**	**9,853 SF**	**9,853 SF**	**9,853 SF**	**8,611 SF**	**9,853 SF**
Passenger Security Screening Checkpoint						
Screening Lanes (TSA PreCheck included)						
North Checkpoint	2	6	6	6	5	6
South Checkpoint	2	4	4	4	3	4
Total (Existing Configuration)	4	10	10	10	8	10
Total Centralized Facility	-	8	9	8	7	9
Checkpoint Area (Security Screening/Queue/Allowance for Equipment Changes)						
North Checkpoint	2,228 SF	9,426 SF	9,710 SF	9,518 SF	7,336 SF	9,625 SF
South Checkpoint	3,486 SF	6,705 SF	6,873 SF	6,760 SF	4,740 SF	6,823 SF
Total (Existing Configuration)	5,714 SF	16,132 SF	16,583 SF	16,277 SF	12,076 SF	16,448 SF
Total Centralized Facility	-	12,904 SF	15,185 SF	13,063 SF	12,375 SF	15,037 SF
TSA Support Space Area						
Total (Existing Configuration)	2,753 SF	1,291 SF	1,327 SF	1,302 SF	966 SF	1,316 SF
Total Centralized Facility	-	1,032 SF	1,215 SF	1,045 SF	990 SF	1,203 SF
Passenger Security Screening Checkpoint Total (Existing Configuration)	**8,467 SF**	**17,422 SF**	**17,909 SF**	**17,580 SF**	**13,042 SF**	**17,763 SF**

Functional Area	Existing Facility	New ULCC 2038	New LCC 2038	Canadian 2038	Loss of LCC 2038	Upgauging 2038
Annual Enplanements	**591,558**	**907,912**	**1,020,874**	**944,414**	**787,012**	**987,012**
Peak Hour Enplanements[1]	**474**	**727**	**817**	**756**	**630**	**790**
Passenger Security Screening Checkpoint Centralized Facility Total	-	**13,937 SF**	**16,400 SF**	**14,108 SF**	**13,365 SF**	**16,240 SF**
Passenger Lounges/Holdrooms[4]						
North Side						
Holdroom Area (Seated/Standing/Ticketing/Boarding/Amenities)	6,124 SF	4,390 SF	4,604 SF	4,492 SF	4,054 SF	4,526 SF
Holdroom Circulation Area	4,738 SF	1,537 SF	1,611 SF	1,572 SF	1,419 SF	1,584 SF
Restrooms	432 SF	627 SF	658 SF	642 SF	579 SF	647 SF
North Side Area Total	**11,294 SF**	**6,554 SF**	**6,873 SF**	**6,706 SF**	**6,052 SF**	**6,757 SF**
South Side						
Holdroom Area (Seated/Standing/Ticketing/Boarding/Amenities)	4,174 SF	3,479 SF	3,634 SF	3,529 SF	3,314 SF	3,485 SF
Holdroom Circulation Area	6,563 SF	1,218 SF	1,272 SF	1,235 SF	1,160 SF	1,220 SF
Restrooms	684 SF	497 SF	519 SF	504 SF	473 SF	498 SF
South Side Area Total	**11,421 SF**	**5,194 SF**	**5,425 SF**	**5,268 SF**	**4,947 SF**	**5,203 SF**
Inbound Baggage Handling and Claim						
Baggage Claim						
Baggage Claim Frontage	249 LF	416 LF	468 LF	433 LF	361 LF	452 LF
Baggage Claim Unit Area	8,191 SF (shared)	2,500 SF	2,500 SF	2,500 SF	2,500 SF	2,500 SF
Passenger Queue & Bag Retrieval Area	8,191 SF (shared)	2,287 SF	2,572 SF	2,379 SF	1,983 SF	2,487 SF
Allowance for Meeters/Greeters	8,191 SF (shared)	718 SF	761 SF	732 SF	672 SF	748 SF
Baggage Claim Area Circulation	8,191 SF (shared)	1,245 SF	1,319 SF	1,269	1,166	1,297
Baggage Service Office	-	718 SF	761 SF	732 SF	672 SF	748 SF
Restrooms	-	747 SF	791 SF	761 SF	699 SF	778 SF
Inbound Baggage Handling						
Take-Off Belt Area	4,465 SF (shared)	1,700 SF	1,700 SF	1,700 SF	1,700 SF	1,700 SF
Allowance for Baggage Train Circulation	4,465 SF (shared)	510 SF	510 SF	510 SF	510 SF	510 SF
Allowance for Conveyor Belt & Equip. Belts/Equipment	4,465 SF (shared)	102 SF	102 SF	102 SF	102 SF	102 SF
Inbound Baggage Handling and Claim Area Total	**12,905 SF**	**10,527 SF**	**11,016 SF**	**10,685 SF**	**10,004 SF**	**10,870 SF**
Concessions						
Pre-Secure Concession Area (Service/Support)	5,925 SF	4,494 SF	5,053 SF	4,675 SF	3,896 SF	4,886 SF
Post-Secure Concession Area (Service/Support)	4,215 SF	10,486 SF	11,791 SF	10,908 SF	9,090 SF	11,400 SF
Concessions Area Total	**10,140 SF**	**14,981 SF**	**16,844 SF**	**15,583 SF**	**12,986 SF**	**16,286 SF**
Core Terminal Areas Subtotal	**68,813 SF**	**70,583 SF / 72,565 SF**	**74,020 SF / 76,015 SF**	**71,748 SF / 73,717 SF**	**61,895 SF / 63,911 SF**	**67,939 SF / 65,923 SF**
Other Functions and Tenant Areas[5]	**70,787 SF**	**25,012 SF**	**27,737 SF**	**25,727 SF**	**22,391 SF**	**27,357 SF**
Total Terminal Building Area	**139,600 SF**	**95,595 SF / 97,577 SF**	**101,757 SF / 103,752 SF**	**97,475 SF / 99,444 SF**	**84,286 SF / 86,302 SF**	**95,296 SF / 93,280 SF**

5.3.3.3 Outbound Baggage Make-Up and Screening

As previously discussed, the outbound baggage screening facilities are behind the airline ticketing counters within the check-in hall. Level 1, 2, and 3 TSA screening takes place within this space. Under all modelled scenarios it is estimated that these facilities are, and will continue to be, severely undersized compared to demand. The existing space does not provide adequate room for support space or future expansion allowance. Under the baseline condition, there is an estimated space deficit of 2,593 SF for baggage screening. Under the additional modelled scenarios this deficit is expected to increase, with the most demanding scenario yielding a space deficit of 3,835 SF.

Baggage make-up space, including baggage train circulation and mechanical support, is expected to be adequate throughout the planning period across all modelled scenarios. This area shows a surplus in space of 1,108 SF. Areas expecting to maintain surpluses in space may be repurposed to resolve facility deficits where possible.

Recommendation: It is recommended that surpluses in airline ticketing office space and baggage make-up areas be repurposed to accommodate deficits in the outbound baggage screening facilities. New facility space should be shared between multiple airlines and not correlated and confined to specific set of ticket counters.

5.3.3.4 Passenger Security Screening Checkpoint

As previously discussed, passenger security screening requirements were modelled under the current configuration, with separate north and south checkpoints, as well as under a centralized checkpoint configuration. Based on the model, it is expected that a centralized screening checkpoint will require fewer lanes and less total space over the planning period.

Assessing the existing configuration, it is estimated that five screening lanes will be required at the north checkpoint and three lanes at the south checkpoint by 2038 under the baseline scenario, which exceeds the existing condition by three lanes and one lane, respectively. Associated space deficits are 5,108 SF and 1,254 SF at the north and south checkpoints respectively by 2038. Should a centralized facility be implemented, it is estimated that six lanes will be required by 2038, rather than a total of eight under the existing configuration, as a result of realized efficiencies. TSA support space is also estimated to be less under a centralized configuration (823 SF) compared to the existing configuration (966 SF) in 2038. TSA support space is expected to maintain a surplus of space throughout the planning period, with an additional 1,787 SF of space above the 2038 requirement. This additional space may be repurposed to meet capacity constraints in the short-term. In total, demand under the existing configuration yields a deficit of 4,575 SF compared to a 2,645 SF deficit under a centralized configuration in 2038.

Under the additional scenarios modelled, severe shortages in screening lanes and space allotment are expected by 2038. Lane requirements range from eight to ten under the existing configuration and seven to nine under a centralized facility by 2038 based on modelled scenarios. Associated space constraints are also expected under the additional scenarios, with deficits ranging from 4,575 SF to 9,442 SF under the existing configuration and 4,898 SF and 7,933 SF under a centralized configuration.

Recommendation: It is recommended that security screening be centralized if feasible. Should the ability to consolidate passenger screening facilities be limited, construction of additional concourse space may be required to accommodate expansion of the north and south passenger security checkpoints. Surpluses in TSA support space may be repurposed for screening facilities to mitigate capacity impacts in the short-term.

5.3.3.5 Concourse Gates and Passenger Boarding Bridges

Passenger gate modelling estimated narrowbody EQAs required throughout the planning period. Under this approach, a large regional aircraft gate, servicing an E175, is equal to half of a narrowbody gate. Based on this, the north concourse has approximately 4.5 narrowbody EQAs, with five useable large regional gates and two narrowbody gates. The south concourse has five narrowbody EQAs with two useable large regional gates and four narrowbody gates. Future demand under the baseline scenario is expected to require one additional narrowbody EQA gate by 2038. Under the most demanding scenario, an additional two narrowbody EQA gates will be required.

Recommendation: The placement of additional gates will require coordinated holdroom space planning, as discussed in the next section. With the potential for upgauging at BTV, it is recommended that any added gates are full narrowbody positions, rather than a combination of large regional jet positions. Based on the airfield environment at the Airport. these positions will most readily be accommodated on the south concourse.

5.3.3.6 Passenger Lounges/Holdrooms

As detailed in Chapter 2 – *Inventory*, observation of holdrooms at BTV reveals clear space constraints for passengers in these areas. As shown in **Table 5-14** and **Table 5-15**, modelling indicates adequate total space allowance for the north and south holdroom areas throughout the planning period for all modelled scenarios. However, the layout of these terminals reduces the utility of existing space for passengers and creates congestion points.

The largest portion of holdroom and concourse circulation space reserved within the north concourse is not adjacent to the highest concentration of gates and is not regularly used by passengers waiting for departure. As a result, a large portion of demand in the north concourse holdrooms is focused within a 3,492 SF space for Gates 2 to 5. This holdroom area gets congested as it is being used as both a holdroom and circulation since passengers generally do not utilize the holdroom area that is not adjacent to the gates. Therefore, although the total space provided should be adequate to meet forecast demand, the way that the terminal is being used shows deficiencies and congestion points.

The south concourse also has constrained areas due to its layout. In this case, the south concourse circulation space is limited to allow bi-directional traffic only for arriving and departing passengers. This space is further restricted by the proximity to the south passenger security checkpoint. It is expected that as gates are added to this concourse or upgauging occurs, reconfiguration or expansion may be required.

Recommendation: It is recommended that holdroom space on the north and south concourses be reconfigured to achieve better utility. Additional flexibility on each concourse may be achieved should a centralized passenger screening facility be implemented. Should this not be feasible, minor expansions may relieve congestion during peak times.

5.3.3.7 Inbound Baggage Handling & Baggage Claim

Modelling of inbound baggage handling and claim show deficits in linear frontage of baggage claim carousels by 2038 for all scenarios. The ultimate requirement calls for 321 LF of baggage claim frontage under the baseline scenario and 468 LF under the most demanding additional scenario. For reference, the existing units provide approximately 125 LF each, so multiple claim units of the same size, or one larger unit will be required in the future. Space for inbound baggage handling is expected to be sufficient throughout the planning period under all modelled scenarios. Additional space consideration may be needed for take-off belt area depending on the configuration of future claim units.

Recommendation: It is recommended that additional baggage claim frontage be added to accommodate future demand. The future number and size of baggage claim units will largely depend on the flight size and scheduling with the goal of providing the total LF of claim frontage required.

5.3.3.8 Concessions

The analysis reveals a surplus in pre-security concessions and deficit in post-security concessions throughout the planning period under all scenarios modelled. This is common among airports that have not been modernized since the attacks of September 11th. The attacks triggered new security regulations that deterred passengers from spending their pre-flight time in the unsecured area of the terminal, which was common leading up to this point. With higher security requirements, time through screening increased and passengers began moving through security as soon as possible and spend their remaining pre-flight time in the secure area of the terminal.

Recommendation: It is recommended that post-security concession space be increased to accommodate expected future demand in coordination with a reconfiguration of the passenger screening checkpoint. Surpluses in administrative, support, and unused space on the second floor of the terminal may be repurposed for concession space. Should the passenger security screening area be reconfigured into a centralized facility, the opportunity to repurpose previously used space on the north and south holdroom areas for concessions and associated circulation areas may be available.

5.3.3.9 Other Terminal Support Facilities

Terminal support facilities include airline ticket/operations offices, ground handling service support, airport operations and maintenance support, building structure allowance, vertical circulation, mechanical/electrical/utilities, and additional tenant office space. This is the area that shows the greatest surplus for all functional areas and is not considered a core functional area within the terminal. This surplus is largely concentrated on the second floor, where a surplus of office space is located, in conjunction with circulation space surrounding the mezzanine level that does not directly support a core functional area. These areas will likely need to be reconfigured to accommodate deficits in core functional areas including passenger screening and post-security concessions space.

Recommendation: It is recommended that office and support space be reconfigured to the edges of the terminal footprint, away from boarding gates, to allow the greatest flexibility of space near the center of the terminal to accommodate passenger security screening, holdroom, and post-security concessions requirements. Airline support space should be consolidated on the first floor near the check-in area as much as possible to achieve efficiencies and repurpose the surplus of space on the second floor. The additional circulation space overseeing the lobby area on the second floor may need to be reconfigured to be better utilized by passengers near holdrooms and post-security concessions. This will be addressed in the Alternatives chapter.

5.4 Parking and Roadway Access Facility Requirements

To determine future parking and roadway access facility requirements at BTV, the performance of existing facilities was assessed via on-site assessment and observations during peak periods of scheduled passenger service. Performance and capacity-related data and information presented in Chapter 2, *Inventory of Existing Conditions* supplements this assessment. This section presents an analysis of parking and roadway requirements to accommodate future levels of landside activity. The analysis and results are presented in the following sections:

- Roadway Facilities Assessment
- Roadway Facilities Performance Key Findings
- On-Site Parking Assessment
- On-Site Parking Performance Key Findings

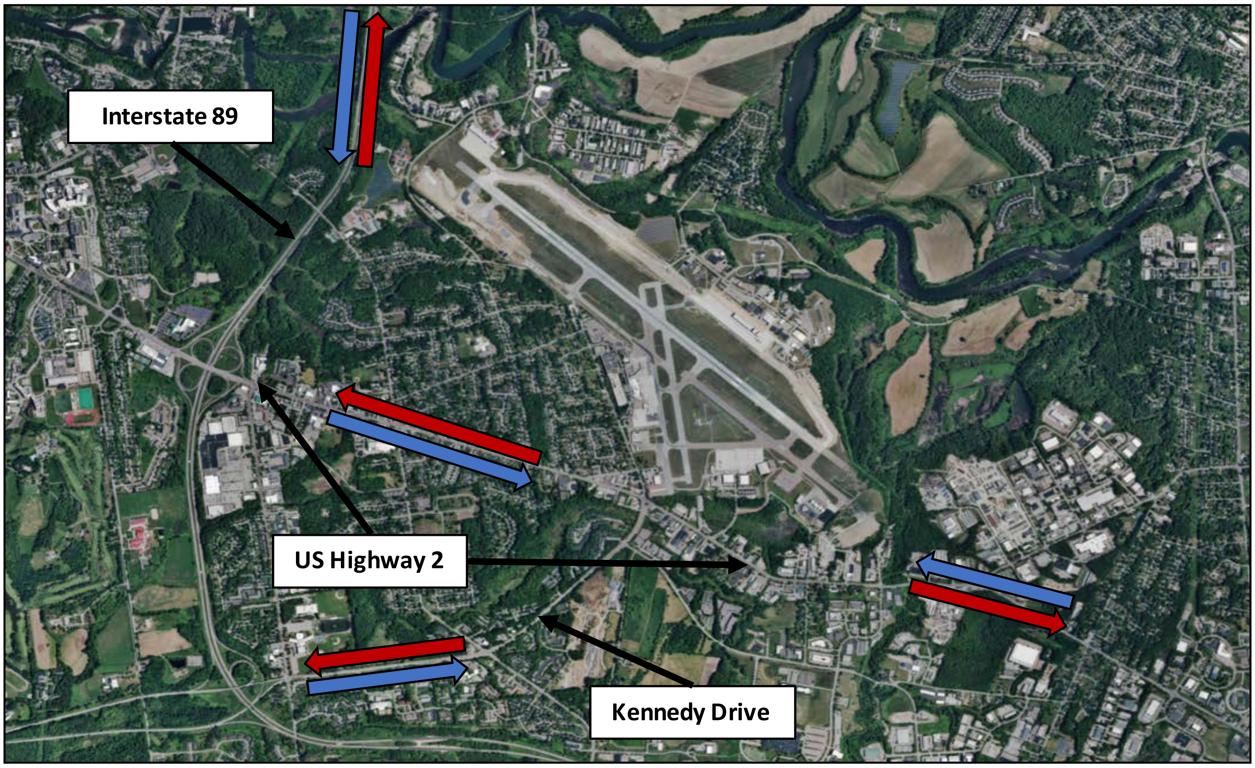
5.4.1 Roadway Facilities Assessment

The following summarizes the facilities considered in the roadway facilities assessment:

- Airport Access: There are three main roads that flow into BTV's primary access road, Airport Drive. The main access points to the Airport are Interstate 89 (I-89) for traffic originating north of the Airport or Canada, Kennedy Drive for traffic originating from south of the Airport, and U.S. Highway 2 for all traffic originating east of the Airport as well as downtown Burlington. The current airport access flow can be seen in **Figure 5-7.**

- Airport Entrance Road and Circulation: The airport entrance road, Airport Circle, is a one-way, two-lane road. Prior to the terminal curb, the road is split by a tree-lined median. To the left, there are two lanes of traffic designated for commercial vehicles. To the right, there are four lanes dedicated to all other traffic including a thru lane to the far left and the remaining three lanes for passenger pick-up and drop-off. The lane closest to the terminal is covered by a canopy. At the end of the 620-foot passenger curb, both commercial traffic and passenger pick-up and drop-off lanes of Airport Circle merge back into a two-lane road which then provides access to a three-lane parking garage entrance on the left. Following the terminal building and the end of the parking garage is the entrance to the Airport Traffic Control Tower (ATCT) on the right and the rental car return on the left. Finally, the roadway splits again prior to reaching Airport Drive, into a left turn only lane and right turn only lane.

Figure 5-7: Current Airport Access Flow



Source: McFarland Johnson Analysis, 2019. 2017 Aerial Imagery

5.4.2 Roadway Facilities Performance Key Findings

Based on observations and airport user and tenant staff interviews, roadway congestion associated with the intersection of Airport Drive and U.S. Highway 2 are a result of non-airport traffic. Furthermore, the peak hour of traffic for airport users does not overlap with peak rush hour commuter traffic traveling along U.S. Highway 2 to access Interstate 89. Feedback from passenger surveys did not indicate issues with Airport access from either Interstate 89 or U.S. Highway 2.

It is expected that Airport Drive will adequately meet the traffic demands of the Airport. However, improved, more prominent airport signage at the intersection of Airport Drive and U.S. Highway 2 would improve wayfinding to the Airport. It is also estimated that Airport Circle will meet demand throughout the planning period.

Recommendation: Traffic congestion associated with the intersection of Airport Drive and U.S. Highway 2 should be addressed at regional level to determine collaborative, regional solutions. If short-term Airport access road improvements are desired, improved entrance signage should be considered.

5.4.3 On-Site Parking Assessment

The following summarizes the facilities considered:

- Terminal Parking Garage: The terminal parking garage has a total of 2,238 parking spots available for passenger parking. Currently, 262 parking spaces in the terminal garage are occupied by rental cars.

- Paved Surface Parking: The Airport maintains an employee lot and an employee/overflow parking lot. The employee parking lot has 104 parking spaces while the overflow lot has 343 parking spaces. In addition, there are twelve paved parking spaces along Airport Circle directly across from the air traffic control tower for their use.
- Cell Phone Lot: A cell phone lot is located at the north end of Airport Drive on the east side of the road. This gravel lot is approximately 7,500 SF.

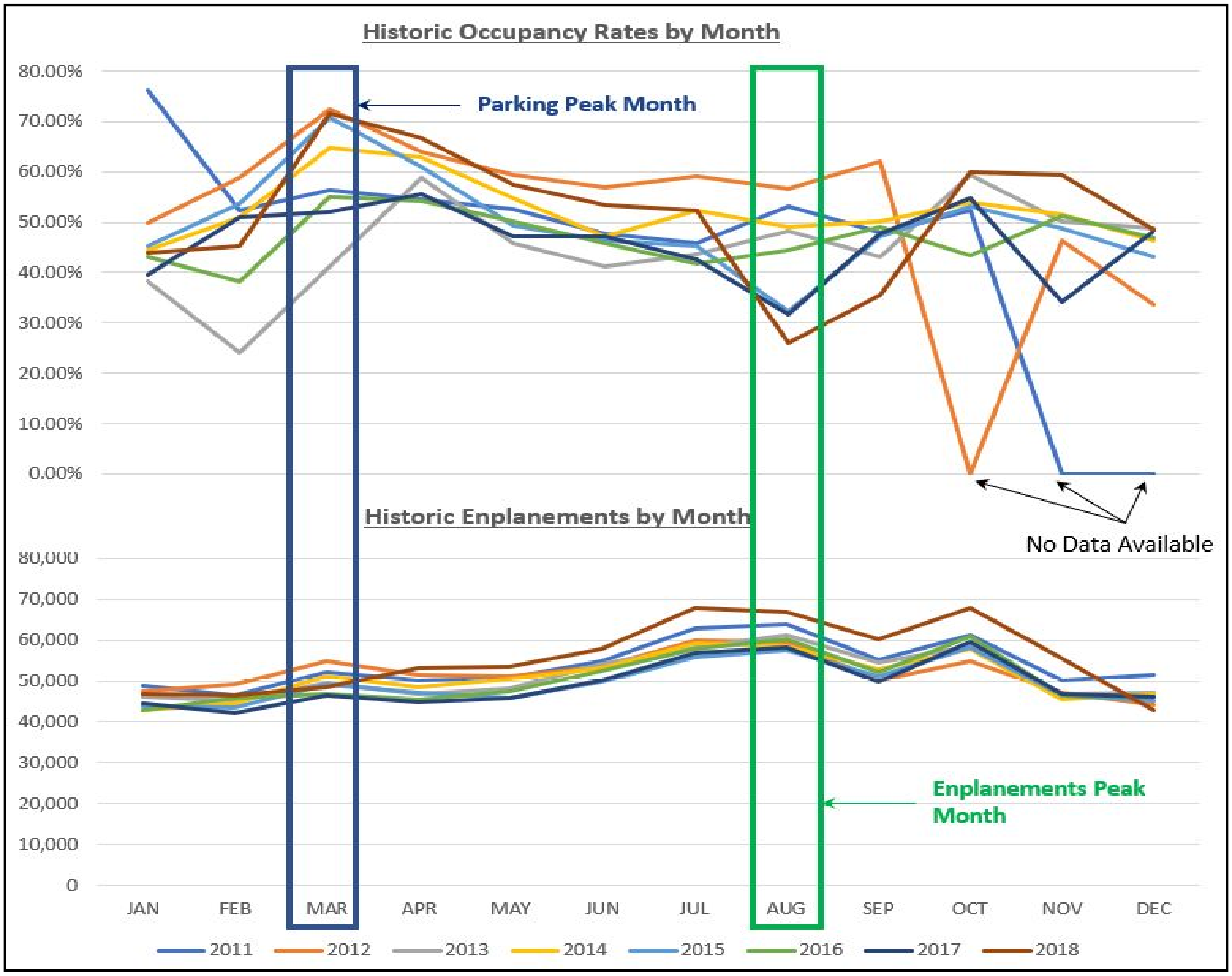
5.4.3.1 Forecast of Peak Period Passenger Parking Demand

Drawing on the forecast of annual enplanements in Chapter 3, *Aeronautical Forecasts*, and recent counts of vehicles parking in the terminal parking garage at the Airport, an estimate of peak parking demand for the 20-year planning period was determined.

Figure 5-8 presents recent counts of vehicles parked and forecast levels of peak passenger enplanements. Shown data was collected monthly from January 2011 through December 2018.

To estimate future parking demand, an analysis of monthly parking data was conducted. The analysis assumed that half of all monthly enplanements were originating, and of those passengers, 80 percent will use the parking garage with an estimated two passengers per car. A secondary ratio analysis based on historic parking counts versus enplaned passengers was conducted to verify the assumptions used in this analysis were reasonable. **Table 5-16** presents the forecast of parking garage demand during peak periods at BTV across all forecast scenarios assuming cars remain in the garage for a duration of four days on average. **Table 5-17** presents the same information to visually show the percent of capacity used by forecasted demand, with green representing low utilization and red representing high utilization of the terminal parking garage.

Figure 5-8: Historic Occupancy Rates Compared to Enplanements by Month



Source: McFarland Johnson Analysis, 2019

Table 5-16: Peak Occupancy (4-day Duration)

Forecast	2018	2023	2028	2038
Baseline	1,270	1,324	1,380	1,499
New ULCC	-	1,443	1,536	1,729
New LCC	-	1,553	1,681	1,944
Canadian	-	1,324	1,380	1,499
Loss of LCC	-	1,257	1,380	1,499
Upgauging	-	1,419	1,571	1,880

Source: McFarland Johnson Analysis, 2019

Table 5-17: Peak Utilization Rates in Parking Garage

Forecast	Baseline	New ULCC	New LCC	Canadian	Loss of LCC	Upgauging
2019	57%	61%	67%	58%	54%	58%
2020	58%	62%	68%	59%	55%	59%
2021	58%	63%	68%	60%	55%	61%
2022	59%	64%	69%	61%	56%	62%
2023	59%	64%	69%	62%	56%	63%
2024	60%	65%	73%	63%	60%	65%
2025	60%	66%	74%	64%	60%	66%
2026	61%	67%	74%	65%	61%	67%
2027	61%	68%	75%	67%	61%	69%
2028	62%	69%	75%	68%	62%	70%
2029	62%	69%	79%	69%	62%	72%
2030	63%	70%	79%	70%	63%	73%
2031	63%	71%	80%	71%	63%	74%
2032	64%	72%	80%	73%	64%	76%
2033	64%	73%	81%	74%	64%	77%
2034	65%	74%	85%	75%	65%	78%
2035	65%	75%	85%	76%	65%	80%
2036	66%	75%	86%	78%	66%	81%
2037	66%	76%	86%	79%	66%	83%
2038	67%	77%	87%	80%	67%	84%

Source: McFarland Johnson Analysis, 2019

5.4.3.2 Forecast of Rental Car Parking Demand

The on-site terminal area parking must be able to accommodate parking required for rental car agencies in additional to passenger parking at BTV. Existing conditions have all on-site rental car parking located in the terminal parking garage and an additional surplus of rental vehicles parking in an overflow lot at the end of Airport Drive located across from the cell phone lot. Enplanement numbers were used to make assumptions about peak demand. It is assumed that during high influxes of passengers, rental car demand will go up versus a large outflux of passengers where demand is assumed to go down.

5.4.4 On-Site Parking Performance Key Findings

It was identified that March was the peak month for parking garage utilization rates. The peak month represents approximately ten percent of the annual number of cars utilizing parking facilities at the Airport. The peak month for on-site parking was found to have an inverse relationship with the peak month of enplanements at the Airport, as shown in **Figure 5-8**. By ensuring there is appropriate space during parking peak months rather than enplanement peak months, the Airport may avoid overbuilding parking facilities. When analyzing peak month rental car utilization, the numbers of enplanements was used to interpolate rental car demand.

Reconfiguration of parking space allocation between rental car and public parking space may be needed to accommodate these fluctuations, but it is estimated that an expansion in parking facilities will likely not be needed to accommodate future demand.

Recommendations: It is recommended that parking barriers within the garage be moveable to accommodate for the inverse peak months of parking and enplanements. No additional parking spaces are recommended.

5.5 General Aviation and Landside Facility Requirements

The existing general aviation (GA) areas are located on the south side of the Airport. 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 BTV were calculated on the basis of data collected during the inventory of existing conditions, forecasts of aviation demand, consultation with Airport staff, as well as FAA standards. The following facilities were examined:

- Aircraft Hangars
- Aircraft Parking Apron
- Aviation Fuel Storage and Distribution
- General Aviation Auto Parking

The existing GA facilities at BTV are shown in **Figure 5-9.**

5.5.1 Aircraft Hangars

There are five conventional GA hangars, four alert pods (two of which are used for maintenance only), and 18 total individual/t-hangar units at the airport for both based and itinerant aircraft. Currently, the Airport is at capacity for aircraft storage. Ideally, 100 percent of aircraft would be stored in hangars. **Table 5-18** shows the aircraft storage demand that is needed above and beyond the current capacity. This calculation is done to include all projected based aircraft growth independent of an existing wait list.

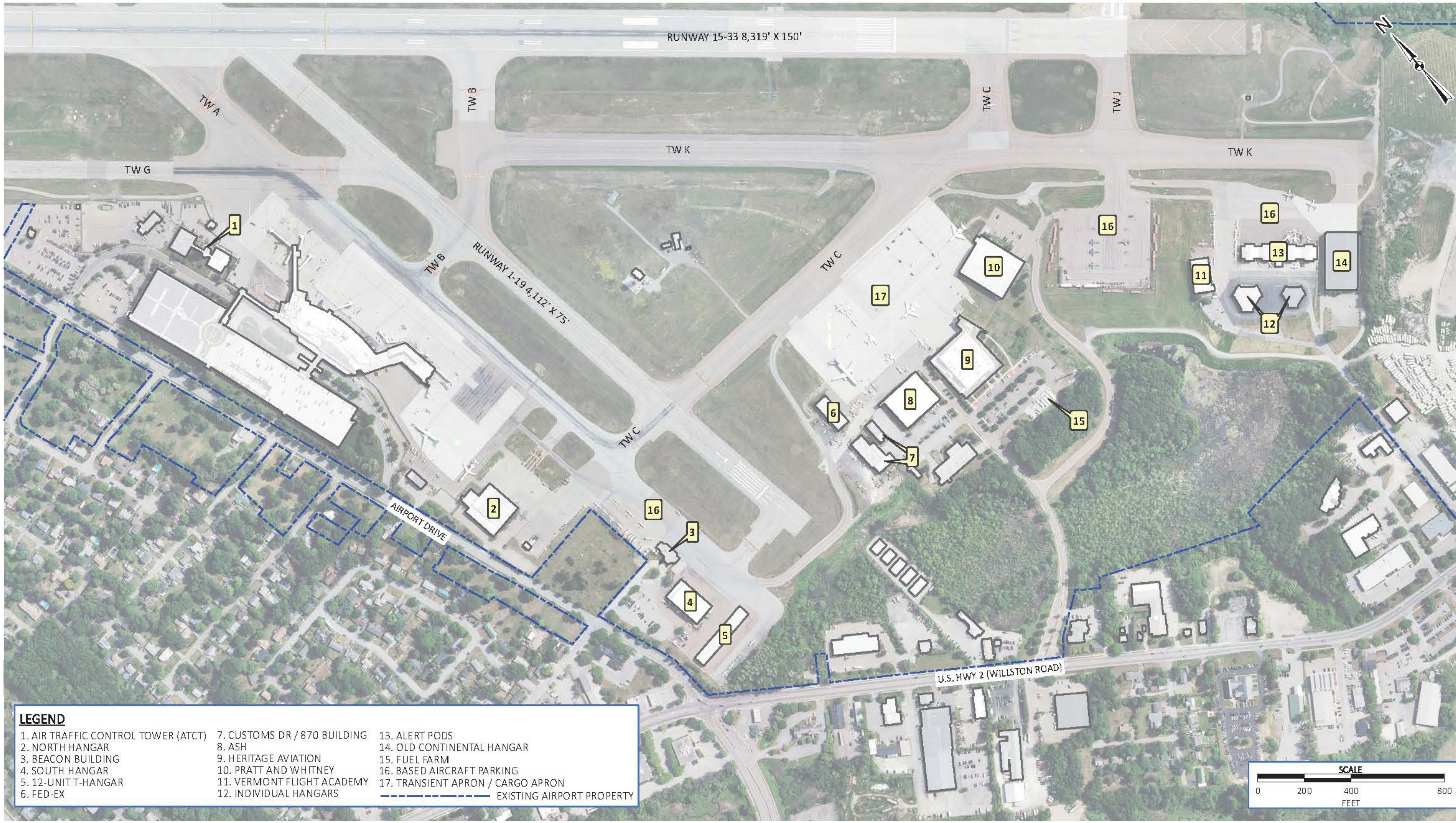
*Table 5-18: GA Aircraft Storage Additional Demand Over Existing**

Year	Conventional Hangar Space (SF)	T-Hangar/Box Units
2018	3,200	0
2023	6,400	1
2028	15,240	1
2038	25,760 (4-5 Conventional Hangars)	2

**Not including Military demand or facilities or aircraft on wait lists*
Source: McFarland Johnson, 2019

Recommendation: The addition of conventional hangar space is recommended to meet both current and future hangar demands for based aircraft at the Airport.

Figure 5-9: General Aviation Facilities



5.5.2 Aircraft Parking Apron

There are four components that typically determine the required apron area for general aviation uses. They are: 1) based-aircraft parking, 2) itinerant aircraft parking (transient apron), 3) aircraft fueling apron, and 4) staging and maneuvering areas. The sum of these components determines the total area of apron required to meet the forecasted level of general aviation activity at the Airport.

5.5.2.1 Based Aircraft Parking

There are approximately 38 tie-downs located throughout the airport. Both Heritage Aviation and Vermont Flight Academy can put down temporary tie-downs.

Recommendations: The current number of aircraft tie-downs are sufficient throughout the planning period. There is no recommendation for additional aircraft tie-downs.

5.5.2.2 Transient Aircraft Parking

Transient aircraft flying into the Airport use Heritage Aviation for their fixed base operator (FBO) services. Therefore, most transient aircraft park on the FedEx/Heritage ramp which is approximately 33,770 square yards (SY). However, there is little distinction between the FBO ramp and the cargo ramp utilized by FedEx. When accounting for cargo apron space, the FBO ramp only accounts for 5,333 SY. **Table 5-19** shows the itinerant apron demands compared to the existing ramp space.

Table 5-19: GA Aircraft Apron Requirements

Year	Itinerant Apron Demand (SY)	Existing FBO Ramp Space (SY)	Surplus (Deficit)
2018	11,484	5,333	(6,151)
2023	11,880	5,333	(6,547)
2028	11,880	5,333	(6,547)
2038	12,672	5,333	(7,339)

**Not including Military demand or facilities or aircraft on wait lists*
Source: McFarland Johnson, 2019

Recommendations: Increasing FBO ramp space and separating cargo operations from GA operations are recommended to meet current and future itinerant apron demand.

5.5.2.3 Staging and Maneuvering Areas

Adequate space for the safe maneuvering of aircraft to and from aprons, hangars, and taxiways must also be included in any forecast of apron requirements. Staging and maneuvering is most closely associated with the provision of space in front of conventional hangars and between rows of box and t-hangars. **Table 5-20** shows the taxiway and taxilane object free area requirements (TOFA and TLOFA, respectively).

Table 5-20: Taxiway/Taxilane Object Free Area Requirements by ADG

ADG	I	II	III
Taxiway OFA	89’	131’	186’
Taxilane OFA	79’	115’	162’

Source: FAA AC 150/5300-13A

Recommendations: Staging and maneuvering areas are sufficient throughout the planning period. No changes are recommended at this time.

5.5.3 Aviation Fuel Storage and Distribution

The Airport currently has five above ground fuel tanks located behind the Heritage Aviation Hangar. There are four 25,000-gallon Jet-A fuel tanks and one 12,000-gallon 100LL fuel tank. Heritage Aviation is the distributor of fuel at the airport and has several fuel trucks parked behind their hangar.

Usage rates were calculated for both Jet-A and 100LL. The following averages were calculated: five-year monthly average, daily average during average month, five-year average for peak month, and daily average during peak month. On an average day, during an average month, approximately 21,518 gallons of Jet-A and 319 gallons of 100LL fuel were sold. On an average day during peak month, approximately 26,310 gallons of Jet-A and 467 gallons of 100LL fuel were sold.

At these rates, the Airport has a three to four-day storage supply of Jet-A fuel and 25 to 37 day storage supply of 100LL fuel.

Recommendations: Consideration should be given to adding an additional Jet-A fuel tank if demand continues to increase.

5.5.4 General Aviation Auto Parking

Corporate hangars for Heritage Aviation, ASH, and Pratt and Whitney have large adjacent vehicle parking lots. There is a shared parking lot for the South Hangar, Beacon building, and 12-unit t-hangar. North Hangar has its own adjacent parking lot. There is an unmarked parking lot outside of the Old Continental Hangar. There are also two rows of parking spots near the Valley Hangar. In total, there are an estimated 250 to 300 parking spaces for GA purposes.

Recommendations: The supply of GA auto parking is considered sufficient throughout the planning period. There is no recommendation for additional GA auto parking.

5.6 Support Facilities

5.6.1 Air Traffic Control Tower (ATCT)

The current ATCT is located north of the airport terminal along Airport Circle. The tower is operated between 5:30 AM and midnight local time.

Recommendations: No improvements to the ATCT are recommended.

5.6.2 Aircraft Rescue and Fire Fighting (ARFF)

The Airport is designated an Index B. ARFF is provided by Vermont Air National Guard which is located on the North side of the airfield.

Recommendations: No improvements to ARFF are required.

5.6.3 Airfield Maintenance Facility and Snow Removal Equipment (SRE)

Maintenance equipment and SRE are located on the ramp as well as in three hangar locations: North Hangar, Customs Dr, and 870 Building. These total 46,505 SF. A full equipment list can be found in Chapter 2, *Inventory of Existing Conditions.*

Recommendations: A fully consolidated facility located away from cargo and GA areas is recommended.

5.6.4 Holding Bays

Providing holding bays instead of bypass taxiways can enhance capacity. Holding bays provide a standing space for aircraft awaiting clearance and to permit those aircraft already cleared to move to their runway takeoff position. A holding bay should be provided when runway operations reach a level of 30 per hour. The most advantageous place for a holding bay is adjacent to the taxiway serving the runway end primarily used for departures, but it may be satisfactory in other locations.

The airport is in the process of bidding holding bays at the Runway 15 end. Runway 33 is the primary runway end based on wind data for operations and therefore the preferred runway end for a proposed holding bay. At 78,408 operations anticipated in 2038, this remains below the 30 operations per hour for the primary runway.

Recommendation: A holding bay is not anticipated to be needed throughout the planning period. If one is constructed, the preferred location would be near the Runway 33 end and the secondary location at the Runway 15 end.

5.6.5 Deicing Aprons

Aircraft deicing facilities are recommended at airports where icing conditions are expected. This includes airports that serve aircraft that can develop frost or ice on critical surfaces even though the airport itself does not experience ground icing conditions. Aircraft deicing facilities are located either at the gates or away from the gate areas. The latter location is referred to a centralized aircraft deicing facility.

The airport presently has three deicing collection areas:

- North on the main air carrier apron
- 890 Ramp
- Valley West Apron

Recommendation: As apron area is expanded, sizing of the deicing collection areas needs to be considered.

5.7 Facility Requirements Summary

The facility requirements recommended for BTV are summarized in **Table 5-21**. The table highlights the key improvements that are recommended for future development at BTV. A summary of terminal facility requirements is provided in **Table 5-14** and **Table 5-15**.

Table 5-21: Summary of Facility Requirements

Item/Facility	Existing Facility or Capacity		Ultimate Requirement		Deficit	
Runways	**15-33**	**1-19**	**15-33**	**1-19**	**15-33**	**1-19**
Runway Length	8,319’	4,112’	8,319’	4,112’	Mill and Overlay	None
Runway Width	150’	75’	150’	60’	None	None
Runway Safety Areas	500’ Wide; 600’ Prior to Threshold; 1,000’ Beyond RWY End	150’ Wide; 300’ Prior to Threshold;	500’ Wide; 600’ Prior to Threshold; 1,000’ Beyond RWY End	120’ Wide; 240’ Prior to Threshold;	All RSAs should be on Airport Property	All RSAs should be on Airport Property
Runway Object Free Area	800’ Wide; 600’ Prior to Threshold; 1,000’ Beyond RWY End	500’ Wide; 300’ Prior to Threshold;	800’ Wide; 600’ Prior to Threshold; 1,000' Beyond RWY End	250’ Wide; 240’ Prior to Threshold;	ROFAs located off Airport should be acquired via easement or fee simple	None
Runway Protection Zone	200’ Beyond RWY End; RWY 15: 2,400’ Minimum; 2,500’ Length; 1,000’ Inner Width; 1,750’ Outer Width; RWY 33: 5,000’ Minimum; 500’ Inner Width; 1,010 Outer Width	200’ Beyond RWY End; RWY 15: 2,400’ Minimum; 2,500’ Length; 1,000’ Inner Width; 1,750’ Outer Width; RWY 33: 5,000’ Minimum; 500’ Inner Width; 1,010 Outer Width	200’ Beyond RWY End; 1,000’ Length; 500’ Inner Width; 700’ Outer Width RWY 1: 1 Mile Minimum RWY 19: Visual	200’ Beyond RWY End; 1,000’ Length; 250’ Inner Width; 450’ Outer Width RWY 1: 1 Mile Minimum RWY 19: Visual	Acquire control of all land uses w/in RPZs through fee simple or avigation easements for properties not currently under airport control or public	Acquire control of all land uses w/in RPZs through fee simple or avigation easements for properties not currently under airport control or public
Runway Lighting	HIRLs	HIRLs	MIRLs	MIRLs	Replace light bars	None
Runway Visual Aids/ Approach Lights	4-Box PAPI; RWY 15: 1,400’ MALSRs; Runway 33: 1,400’ MALSF	4-Box PAPI	4-Box PAPI; RWY 15: 1,400’ MALSRs; Runway 33: 1,400’ MALSF	4-Box PAPI	None	None
Instrument Approaches	ILS/DME	None	ILS/DME	None	None	None
Taxiways						
Taxiway Width	All Civilian Use TWYs: Range from 75’-116’		All Civilian Use TWYs: Update With Standard Taxiway Nomenclature		None	
Taxiway Lighting	MITLs		MITLs		None	
Passenger Parking	2,238		2,238		Use Movable Barriers to allow for more passenger parking during peak month	

Item/Facility	Existing Facility or Capacity	Ultimate Requirement	Deficit
Rental Car Parking	262	262	Use moveable barriers to allow for more rental car parking during peak month
Individual/ T-Hangars	14 Units	2 units more than current provision	Trend does not point to more T-hangars
Conventional Hangars	5 Conventional Hangars and 4 Alert Pods	25,760 SF more than Current Provision	Add 25,760 SF of Hangar Space (4-5 more hangars)
Transient Parking Apron	5,333 SY	12,672 SY	Add 7,339 SY of Transient Apron
Tie-Downs	38 Plus the Temporary Tie-Downs	38 Plus Temporary Tie-Downs	None
GA Auto Parking	Each Hangar has their own Auto Parking	Each Hangar has their own Auto Parking	None
Maintenance/ SRE Storage	46,505 SF Across 3 Hangars and On the Ramp	One Storage Facility Located Away from GA and Cargo	Create a Consolidated Storage Facility

Note: LF – linear feet, SF – square feet, NA – not applicable
Source: McFarland Johnson analysis, 2019