CHAPTER 3
FACILITY REQUIREMENTS

MASTER PLAN UPDATE
BISMARCK AIRPORT

Prepared for
THE CITY OF BISMARCK
Bismarck, North Dakota

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Version 3.0

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CHAPTER 3
FACILITY REQUIREMENTS

This chapter focuses on the existing and future facility needs of Bismarck Airport. The facility needs and direction for the future of the Airport are based on the existing facilities, forecast aviation activity, and the City's strategic vision and goals for the future of the Airport. Specific facility expansion and airport development alternatives to meet the future facility requirements are addressed in the subsequent chapter.

As discussed in the Aviation Demand Forecast, the master plan derives forecasts and facility needs based on planning activity levels (PALs). This ensures facilities are not built until justifying activity levels exist. Base on the forecast of activity, PALs 1, 2, and 3 correspond to 2010, 2015, and 2025, respectively.

3.1 SUMMARY

A summary of the facility development needed to accommodate the forecast activity at the Airport is provided in this section. Certain identified facilities will need further analysis based on the recommended development alternative. Key conclusions that overarch the detailed facility requirements include:

- The terminal facilities are sufficient to accommodate the forecast 20-year demand.
- Additional vehicle parking in the terminal area is needed.
- The length of the primary runway, Runway 13/31, is sufficient for existing operations. The Master Plan recommends protecting for a 1,206-foot extension based on the City of Bismarck's strategic vision for air cargo aircraft operations associated with the Northern Plains Commerce Centre (NPCC).
- The crosswind runway, Runway 3/21, should be extended to 7,200 feet and widened an additional 50 feet to facilitate the City of Bismarck's strategic vision to accommodate expanded cargo operations.
- The existing airfield is sufficient to accommodate existing and forecast aircraft operations, aircraft parking, and ground handling.
- Taxiway C separation near the Runway 13 end needs to be increased to comply with FAA design standards.
- Existing cargo aircraft parking, ground handling operations, and corporate aircraft hangars should be segregated from other general aviation facilities.
- Facility improvements are needed to provide a clear line of sight from the air traffic control tower to all controlled aircraft movement areas.
- General aviation ramp should be realigned to aid in the segregation of cargo aircraft operations from the general aviation facilities
- The aircraft rescue and firefighting facility is in need of upgrades to meet federal operating regulations, accommodate existing and future vehicles, and efficiently conduct operations.
- Airport maintenance facilities are currently in need of expansion.

3.2 GENERAL

The remainder of this chapter provides the detailed methods and logic upon which the facility requirements are based. After establishing the Airport's role and service level and evaluating the recommended FAA design standards, the chapter describes the needs of the Airport to meet both demand and the City of Bismarck's strategic vision for the Airport. Areas examined include airfield and airspace, passenger service, general aviation, aviation support facilities, and airport access needs.

3.2.1 Airport Role and Service Level

Bismarck Airport is identified in the FAA's National Plan of Integrated Airports System (NPIAS) as a commercial service primary airport. A commercial service primary airport is defined as a passenger service airport that has more than 10,000 annual passenger enplanements in the U.S. on aircraft in service in air commerce.

3.2.2 Critical Aircraft Identification and Airport Reference Code

To determine airfield facility requirements, FAA planning guidelines recommend the identification of an existing and future design aircraft. The design aircraft is typically defined as the most demanding aircraft in terms of size and/or facility needs that performs, or is projected to perform, at least 500 annual operations at an airport. At airports designed to accommodate multiple types of traffic, the runways, taxiways, and aprons, may have different design aircraft. For example, one runway may be designed to accommodate general aviation aircraft and another designed to serve commercial service aircraft.

The airport reference code (ARC) is a coding system used by the FAA to relate airport design criteria to the operational and physical characteristics of the aircraft intended to operate at an airport. The ARC is defined by a letter designating the aircraft approach category, which relates to the approach speed of an aircraft, and a Roman numeral designating the design group, which refers to the wingspan and tail height. The FAA's aircraft approach categories and airplane design groups are listed in Table 3-1.

Table 3-1
AIRCRAFT APPROACH CATEGORY AND AIRPLANE DESIGN GROUP

Approach Category	Approach Speed	
Category A	Speed less than 91 knots	
Category B	Speed 91 knots to less than 121 knots	
Category C	Speed 121 knots to less than 141 knots	
Category D	Speed 141 knots to less than 166 knots	
Category E	Speed 166 knots or more	
Design Group	**Wingspan**	**Tail Height**
Group I	Less than 49 feet	Less than 20 feet
Group II	49 feet to less than 79 feet	20 feet to less than 30 feet
Group III	79 feet to less than 118 feet	30 feet to less than 45 feet
Group IV	118 feet to less than 171 feet	45 feet to less than 60 feet
Group V	171 feet to less than 214 feet	60 feet to less than 66 feet
Group VI	214 feet to less than 262 feet	66 feet to less than 80 feet

The existing design aircraft at Bismarck Airport is the Airbus A320. The A320 is an ARC C-III aircraft; it has a wingspan of 112 feet and an approach speed of 138 knots. Based on the design group criteria alone it could be recommended that the airfield be designed to meet Design Group III standards. However, the majority of the Airport is currently designed to ARC D-IV standards and, while not conducting enough operations to be the design aircraft, there are a number of ARC D-IV aircraft currently operating at the Airport.

In addition, the forecast anticipates the use of B767-300F, a widely used cargo aircraft designed to provide excellent fuel efficiency and operational flexibility. Therefore, the future design aircraft for Bismarck Airport is the B767-300F. The B767-300F is an ARC D-IV; it has a wingspan of 156 feet and an approach speed of 147 knots. Therefore, based on existing airfield design characteristics and the future design aircraft, it is recommended that the existing and future design ARC remain a D-IV.

3.2.3 Wind Coverage

The prevailing winds generally determine runway orientation and the need for a crosswind runway. FAA planning standards recommend that a runway system should provide a minimum of 95 percent wind coverage. If a single runway cannot provide this level of coverage, than an additional crosswind runway may be needed.

A runway wind coverage analysis was conducted using the FAA's Airport Design Microcomputer Program Version 4.2D and data supplied by National Climatic Data Center from the weather reporting station at Bismarck Airport. Weather data covered the 10 year period between 1995 and 2004.

Acceptable maximum crosswind components are generally defined as they relate to the size and performance of an individual aircraft. Smaller general aviation aircraft have a maximum crosswind component of 10.5 knots, while larger and higher performance aircraft can sustain higher crosswinds. Considering the smaller aircraft and a 10.5 knot crosswind, Runway 13/31 provides 94 percent or better wind coverage for all-weather conditions and 88 percent or better wind coverage for Instrument Flight Rules (IFR) conditions, as shown in Table 3-2. For the primary runway, at 13 and 20 knots components, coverage is nearly 100 percent. The combined runway system at the Airport provides 100 percent wind coverage during all-weather and IFR conditions. Therefore, the current runway configuration at the Airport is adequate with respect to providing sufficient wind coverage.

Table 3-2
WIND COVERAGE FOR INDIVIDUAL RUNWAY ENDS

	All Weather				IFR			
	Crosswind Component (kts)				Crosswind Component (kts)			
Runway	10.5	13	16	20	10.5	13	16	20
3/21	79.3%	86.7%	94.1%	97.0%	78.7%	85.9%	92.5%	96.2%
13/31	94.0%	97.2%	99.3%	99.9%	87.7%	93.3%	97.9%	99.5%
Combined	98.3%	99.8%	99.9%	100.0%	97.6%	99.4%	99.9%	100.0%

Source: National Climatic Data Center
Bismarck Airport Reporting Period: 1995-2004

3.3 AIRFIELD REQUIREMENTS

The airfield is the system of components upon which aircraft operate. Airfield requirements are affected by demand; capacity; aircraft mix; runway, taxiway, and gate design standards; airspace; and navigational and visual aids. For planning purposes, it is assumed that airfield components generally do not affect the capacity of another component. Therefore, the capacity of the entire airfield is governed by the component that is most restrictive.

3.3.1 Airfield Demand Capacity

Airfield capacity is an estimate of the number of aircraft that can be processed through the airfield system during a specific period of time with acceptable levels of delay. The airfield demand capacity analysis prescribed for use by the FAA in Advisory Circular 150/5060-5, *Airport Capacity and Delay*, identifies the existing annual capacity, referred to as the annual service volume, and hourly capacity at an airport based on the current operational characteristics. The level of delay that is acceptable to a particular airport may differ from the level deemed acceptable at a similar airport. As a result, the level of delay can influence the estimated capacity for a given airfield.

Major factors that affect airfield capacity include the runway configuration, air traffic control operating procedures, weather conditions, and aircraft fleet mix. For instance, required separation distances between aircraft are greatly increased during inclement weather. As a result, the number of aircraft that can operate at an airport under instrument meteorological conditions will be much less than during visual meteorological conditions. Similarly, the other factors identified would have an effect on overall airfield capacity.

The goal of this analysis is to determine the airfield capacity, annual service volume, and the sufficiency of the runways to handle the peak hour and annual demand. The values developed are compared to the long-range forecasts for the Airport to determine whether any shortfalls exist.

Airfield capacity calculations use a metric referred to as the mix index. The mix index is equivalent to the percent of medium-sized aircraft in the mix, such as large corporate jets and the A320, plus three times the percent of large-sized aircraft in the mix, such as the 767-300. The mix index is a factor in the annual service volume and hourly capacity for an airfield. The mix index can range between zero and 180, where smaller indexes reflect predominately small aircraft in the operational fleet mix and higher indexes represent a larger aircraft fleet mix.

This master plan employs the FAA capacity and delay calculations for long range planning. This method identifies several ranges for mix indexes, with fixed annual service volume (ASV) and hourly capacity with each range. The master plan analysis initially focuses on the capacity and ASV for a single runway. Bismarck Airport had a mix index of 42.8 in 2005. This index is at the high end of the methodology's second range, which includes mix index values between 21 and 50. A nominal decrease in the mix index from 42.8 to 41.4 is expected over the planning period. With implementation of cargo operations associated with the NPCC and increased regional passenger service, the mix index decreases further to 38.8. In either scenario, the mix indexes remain in the same FAA planning range so the capacity and annual service volume remain the same. Results of the long-range capacity analysis are shown in Table 3-3.

Table 3-3
COMPARISON OF FORECAST OPERATIONS AND AIRFIELD CAPACITY

		Planning Activity Level		
	2005	**1**	**2**	**3**
Hourly Capacity				
VFR	74	74	74	74
IFR	57	57	57	57
Peak Hour Operational Demand / Hourly Demand Capacity	20	21	23	25
VFR	27%	28%	31%	34%
IFR	35%	37%	40%	44%
Annual Operational Capacity	195,000	195,000	195,000	195,000
Forecast Annual Operational Demand	53,020	56,150	59,320	65,790
Annual Demand / Capacity	27%	29%	30%	34%

Source: FAA Advisory Circular 150/5060-5 Airport Capacity and Delay

Note: VFR = Visual Flight Rules, IFR = Instrument Flight Rules

Table 3-3 also shows that the forecast annual operations are well below the ASV throughout the planning period. Similarly, forecast peak hour demand is well below the hourly capacity throughout the planning period. Therefore, additional airfield capacity is not needed.

3.3.2 Runway Analysis

The runway analysis addresses the ability of the existing runways at the Airport to accommodate the forecast demand. At a minimum, runways must have the proper length, width, and strength to meet FAA recommended design standards to safely accommodate the design aircraft. This section analyzes specific runway criteria and makes recommendations based on the forecast.

3.3.2.1 Runway Designation

Runway designations provided on each runway, indicate the runway orientation according to the magnetic azimuth. Since the magnetic azimuth changes over time, this section examines the amount of magnetic drift that has occurred to assure that the current designations are appropriate. The runway designation consists of a number and, on parallel runways, is supplemented with a letter. The designation number represents the whole number nearest the magnetic azimuth, divided by 10, when viewed from the direction of approach. For example, where the magnetic azimuth is 163°, the runway designation is 16, and for a magnetic azimuth of 27°, the runway designation is 3.

The magnetic azimuth is determined by correcting the runway's true bearing for magnetic declination. At Bismarck Airport the current magnetic declination is 7° 18' East or 7.33°. Since the magnetic declination is easterly, the magnetic azimuths associated with the runways at the Airport are determined by subtracting the declination value from the true bearing values. The analysis conducted to determine the designations of the runways at the Airport is predicated on information obtained from the National Oceanic and Atmospheric Administration (NOAA).

The true bearing information, shown in Table 3-4 for all runways, is obtained from actual survey data. The runway magnetic azimuths for Runway 13/31 and 3/21 are currently several minutes from requiring runway markings re-designation. With the Airport's annual magnetic declination rate of change of 0^0 9' West per year, it is unlikely that either runway will require re-designation during the planning period. However, at the time either runway is rehabilitated or re-marked, the magnetic azimuth should be reevaluated to ensure that it meets the current magnetic azimuth.

Table 3-4
TRUE RUNWAY BEARING

Runways	Runway True Bearing	Magnetic Declination	Runway Magnetic Azimuth
Runway 13	137° 34' 48.00"	7° 18' East	130° 16' 48.00"
Runway 31	317° 36' 00.00"	7° 18' East	310° 18' 00.00"
Runway 3	039° 01' 12.00"	7° 18' East	031° 43' 12.00"
Runway 21	219° 02' 24.00"	7° 18' East	211° 44' 24.00"

Source: National Geophysical Data Center

3.3.2.2 Design Standards

The FAA recommends runway design standards based upon the design aircraft. The existing design aircraft at Bismarck Airport is the A320 and the future design aircraft is the B767-300F. The FAA recommended design standards shown in Table 3-5 reflect the recommended design standards for the primary and crosswind runway. In addition, the existing design standards for each runway are identified. As portions of an airfield may be designed to meet one standard, while other areas may be designed for another, additional taxiway and taxilane design standards may be identified to serve particular development areas on the airfield.

Table 3-5
RUNWAY DESIGN STANDARDS

Items	D-IV	Rwy 13/31	Rwy 3/21
Runway Width	150'	150'	100'
Runway Shoulder Width	25'	0'	0'
Runway Blast Pad Width	200'	150'	140'
Runway Blast Pad Length	200'	200'	200'
Runway Safety Area Width	500'	500'	500'
Runway Safety Area Length*	600'	600'	600'
Runway Safety Area Length**	1,000'	1,000'	1,000
Runway Object Free Area Width	800'	800'	800'
Runway Object Free Area Length**	1,000'	1,000'	1,000'
Runway Obstacle Free Zone (ROFZ) Length**	200'	250'	200'
ROFZ Inner-Approach OFZ Length**	NA	1,600' / 2,600'	NA
Runway Obstacle Free Zone Width	400'	400'	400'

Source: FAA Advisory Circular 150/5300-13
NA = not applicable
* portion prior to the runway threshold
* * portion beyond the runway end

SHOULDERS

Runway shoulders are typically provided to support aircraft that may inadvertently run off the primary pavement, to improve drainage, and/or provide erosion protection control during aircraft takeoff and landing operations. The Airport's runways do not currently have shoulders. The master plan recommends the addition of shoulders as part of the next runway rehabilitation projects.

BLAST PADS

Blast pads are added at the end of the runways to provide erosion protection control during aircraft takeoff operations. None of the blast pads are compliant with the ARC D-IV standard of 200 feet. It is recommended that all of the blast pads be upgraded to meet D-IV design standards at the time of major runway rehabilitation or runway extension.

3.3.2.3 Runway Protection Zone Analysis

For the protection of people and property on the ground, the FAA has identified an area of land off each runway end as the runway protection zone (RPZ). The size of the zones vary according to the design aircraft characteristics and the lowest instrument approach visibility minimum defined for each runway. It is desirable to have all areas within the RPZ cleared, or at a minimum, maximize ground safety through land use control measures, such as property deeds or avigation easements. The Airport should acquire all property within the RPZs as it becomes available. For paved runways, the trapezoidal-shaped RPZ is centered on the extended runway centerline starting 200 feet from the runway end.

Runway 13 and 31 and have precision instrument approach procedures which utilize the instrument landing system (ILS). Runway 13 approach has a visibility minimum of ¾ mile and Runway 31 has a visibility minimum of ½ mile. Visibility minimums of less than ¾ miles have the largest runway protection zone surface, encompassing approximately 79 acres.

Runway 3 and Runway 21 both have non-precision instrument approach procedures with the lowest visibility being one mile. If Runway 3/21 non-precision approaches are upgraded to precision approach procedures, it is likely that the approaches will provide a minimum visibility of ½ mile, similar to Runway 31. The RPZ dimensional standards for the existing and forecast approach minimums are shown in Table 3-6.

Table 3-6
RUNWAY PROTECTION ZONE DIMENSIONS

	Runway 13/31		Runway 3/21	
	Existing	**Forecast**	**Existing**	**Forecast**
Length	2,500	2,500	1,700	2,500
Inner Width	1,000	1,000	500	1,000
Outer Width	1,510	1,750	1,010	1,510

Source: FAA AC 150/5300-13

It is recommended that the Airport purchase all land located within both the existing and future RPZ. If it is not feasible to own the property, avigation easements should be in place to limit equipment and building heights and land use.

3.3.2.4 Runway Length Requirement

The required runway length is defined by the FAA as that sufficient to accommodate 90 percent of the operational fleet on the longest reasonably expected flight stage length. For airports that need to accommodate new service opportunities to the greatest extent practical, such as Bismarck Airport, the availability to accommodate new service that would enhance airport revenues and community service is very important.

Bismarck Airport has several existing and forecast, aircraft types and destinations that figure prominently into runway length requirements. For this analysis, the master plan process preliminarily screens aircraft types using the Airport and identifies those which have greater runway length requirements.

- The current scheduled airline passenger service is provided by medium size air carrier aircraft and regional jet aircraft. Service is provided primarily to the airline hub cities of Minneapolis, Denver, and Las Vegas located between 300 and 900 nautical miles from Bismarck. The aviation forecast does not anticipate that the aircraft types providing the service or the distance to the primary destination will change throughout the planning period.
- The planned introduction of on-demand passenger service with North Dakota and adjoining states will utilize small general aviation aircraft, for which the existing runway length is sufficient.
- The North Dakota Air National Guard occasionally requires the use of large military transport aircraft for logistical support. Operations by these aircraft are infrequent.
- Large, high-performance corporate aircraft can have significant runway length requirements.
- For the anticipated large, high-performance, long range, heavy air cargo operations associated with the Northern Plains Commerce Centre, the available runway length is insufficient.

Two methods were used to determine the recommended runway lengths. The first method utilizes the FAA's Airport Design Microcomputer Program 4.2D data that supports the runway stage length requirements based on general groups of aircraft (i.e., small and large aircraft) and is helpful in making an overall airfield assessment. The second method utilizes the aircraft manufacturers' planning manuals to determine the specific runway lengths needed for typical aircraft stage lengths and payloads and is a more accurate method to determine the recommended runway length because it is based on aircraft currently using and forecast to use Bismarck Airport.

FAA AIRPORT DESIGN MICROCOMPUTER PROGRAM

Runway length requirements based on the FAA Airport Design Microcomputer Program 4.2D, runway length calculation software, is provided in Table 3-7. This information is calculated by entering the airport elevation, average daily maximum temperature of the hottest month, the maximum difference in runway centerline elevation, and the length of haul for airplanes weighing more than 60,000 pounds.

Table 3-7
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN

Aircraft Category	Recommended Runway Length (FT)
Small Airplanes (Less than 12,500 lbs.)	
100% of Fleet (Less than 10 Seats)	3,810
Small Airplanes (Less than 12,500 lbs.)	
100% of Fleet (10 or More Seats)	4,280
Large airplanes (Between 12,501 lbs.-60,000 lbs.)	
75% of Fleet @ 60% Useful Load	4,900
75% of Fleet @ 90% Useful Load	6,500
100% of Fleet @ 60% Useful Load	5,540
100% of Fleet @ 90% Useful Load	8,210
Large Airplanes (Greater than 60,000 lbs.)	
500 Mile Stage Length	5,250
1,000 Mile Stage Length	6,230
2,000 Mile Stage Length	7,960
3,000 Mile Stage Length	9,380
4,000 Mile Stage Length	10,480
5,000 Mile Stage Length	11,260
6,000 Mile Stage Length	11,740
7,000 Mile Stage Length	11,890

Source: FAA Airport Design Microcomputer Program 4.2D

The stage length from Bismarck to Las Vegas is approximately 1048 nautical miles. Therefore, utilizing the FAA data, the recommended runway length for large aircraft weighing more than 60,000 pounds used to serve comparably distant markets is approximately 6,230 feet.

The master plan identified potential cargo markets which could be served from Bismarck associated with the NPCC. The markets, their significance, and the associated runway length requirement are as follows:

- Memphis, as a primary hub for package freight forwarding, has a runway length requirement of approximately 6,200 feet.
- Los Angeles or New York, as major U.S. cities and primary gateways for cargo forwarding, has a runway length requirement of approximately 6,700 feet.
- Anchorage, as the primary technical stopping point aircraft bound for Pacific Rim nations, has a runway length requirement of approximately 8,100 feet.
- London, as a primary European access location, has a runway length requirement of approximately 10,700 feet.

Based on the FAA Airport Design Microcomputer Program 4.2D, the primary runway length of 8,794 feet is sufficient to serve the domestic market. In addition, the 6,600-foot long crosswind runway exceeds the length required to accommodate the lower crosswind capable aircraft.

AIRCRAFT MANUFACTURERS RUNWAY LENGTH CALCULATIONS

The second method for determining runway length requirements is based on the design aircraft. The existing design aircraft for Bismarck Airport is the Airbus A320, a typically mid-size passenger aircraft. In addition to the Airbus A320, Bismarck is also currently served by the Boeing MD-83 aircraft, , which is more demanding in terms of runway length requirement and has the longest stage length of current scheduled operations. The forecast anticipates the use of B767-300F a widely used cargo aircraft, designed to provide excellent fuel efficiency, and operational flexibility. The B767-300F is more demanding in terms of runway length than both the A320 and MD-83 currently in use. The runway length requirement analysis will consider these aircraft and their potential cargo destinations.

Once the design aircraft are determined, the aircraft specific performance characteristics provided by the aircraft manufacturers are analyzed to determine specific runway lengths based on airport characteristics and operating conditions, load carried by the aircraft, and the route segment distance.

As shown in Table 3-8, the maximum payload required runway length for the existing design aircraft is 7,292 feet, and for the future design aircraft length ranges from 7,500 feet, for domestic flights to over 12,000 feet for international flights. The existing primary runway at 8,794 feet is capable of supporting the both existing and future design aircraft within the 48 contiguous states. However, to meet the City of Bismarck's strategic vision of accommodating international cargo and charter operations and to remain consistent with the existing FAA approved ALP, this Master Plan recommends protecting for a runway extension to 10,000 feet. This length will accommodate large aircraft over 60,000 pounds in weight and a stage length of nearly 4,000 miles.

AC 150/5325-4B, *Runway Length Requirements for Aircraft Design,* states that the crosswind runway needs to accommodate the largest ARC that does not have 95 percent wind coverage on the primary runway. Based on the wind analysis, at a minimum the crosswind runway must accommodate ARC B-II aircraft. Therefore, as the primary runway is extended to meet the City of Bismarck's strategic vision to accommodate international cargo operators utilizing ARC D-IV aircraft, the crosswind runway should also be extended. This Master Plan recommends protecting for a crosswind runway extension to 7,200 feet. A length that is sufficient to accommodate most large aircraft with a stage length less than 2,000 miles.

Table 3-8
SPECIFIC RUNWAY LENGTH REQUIREMENTS

Aircraft Type	Destination	Stage Length (NM)	Take-Off Length Standard Day (FT)	Take-Off Length Hot Day (FT)	Landing Length[1] (FT)
A-320	Minneapolis	386	5,000	7,292	5,000
	Denver	516	5,100	6,642	5,000
MD-83	Las Vegas	1,048	6,825	7,350	6,000
767-300	Memphis	984	7,085	7,500	6,550
	Los Angeles	1,280	7,560	8,050	6,550
	New York	1,394	7,800	8,225	6,550
	Mexico City	1,886	8,250	8,780	6,550
	Anchorage	2,173	8,785	9,840	6,550
	London	4,195	12,830[2]	12,440[2]	6,550

Notes: 1 Distance based on maximum gross landing weight and wet runway.
2 Take distance limited by maximum weight.

3.3.2.5 Pavement Strength

Pavement strength is an important criterion in determining the usability of the runways. As shown in Table 3-9, Runway 13/31 and Runway 3/21 have bearing capacities designed for the typical large air carrier aircraft using the Airport. A list of sample aircraft, gear configurations, and maximum certificated weights are listed in Table 3-10.

Table 3-9
RUNWAY WEIGHT BEARING CAPACITY

Item	Runway 13/31	Runway 3/21
Runway Length	8,794'	6,600'
Runway Width	150'	100'
Pavement Type	Asphalt	Asphalt
Pavement Strength (lbs)		
Single Wheel Gear	130,000	130,000
Dual Wheel Gear	180,000	180,000
Dual Wheel Tandem Gear	340,000	340,000

Table 3-10
AIRCRAFT BEARING CRITERIA

Aircraft Type	Gear Configuration	Maximum Weight (LBS)
Cessna 150	Single Wheel Gear	1,600
Cessna Citation III	Single Wheel Gear	22,000
Piper Seneca	Single Wheel Gear	12,050
Beech King Air C-90-1	Single Wheel Gear	9,650
Lear 35	Dual Wheel Gear	18,300
DC-9	Dual Wheel Gear	110,000
A320	Dual Wheel Gear	145,505
B-727-200	Dual Wheel Gear	209,500
A-300-600	Dual Tandem Wheel	363,763
B-767-300	Dual Tandem Wheel	350,000
DC-8-73F	Dual Tandem Wheel	355,000
DC-10-30	Dual Tandem Wheel	590,000
B-747-200	Double Dual Tandem	833,000

Source: FAA Advisory Circular 150/5300-13 & Aircraft Manufacturers

Runway 13/31 currently has weight ratings of 130,000 lbs single-wheel, 180,000 lbs dual-wheel, and 340,000 lbs dual-tandem-wheel. In order to accommodate potential cargo operations using B767-300 and B747 aircraft, the runway would require an asphalt overlay of four to six inches.

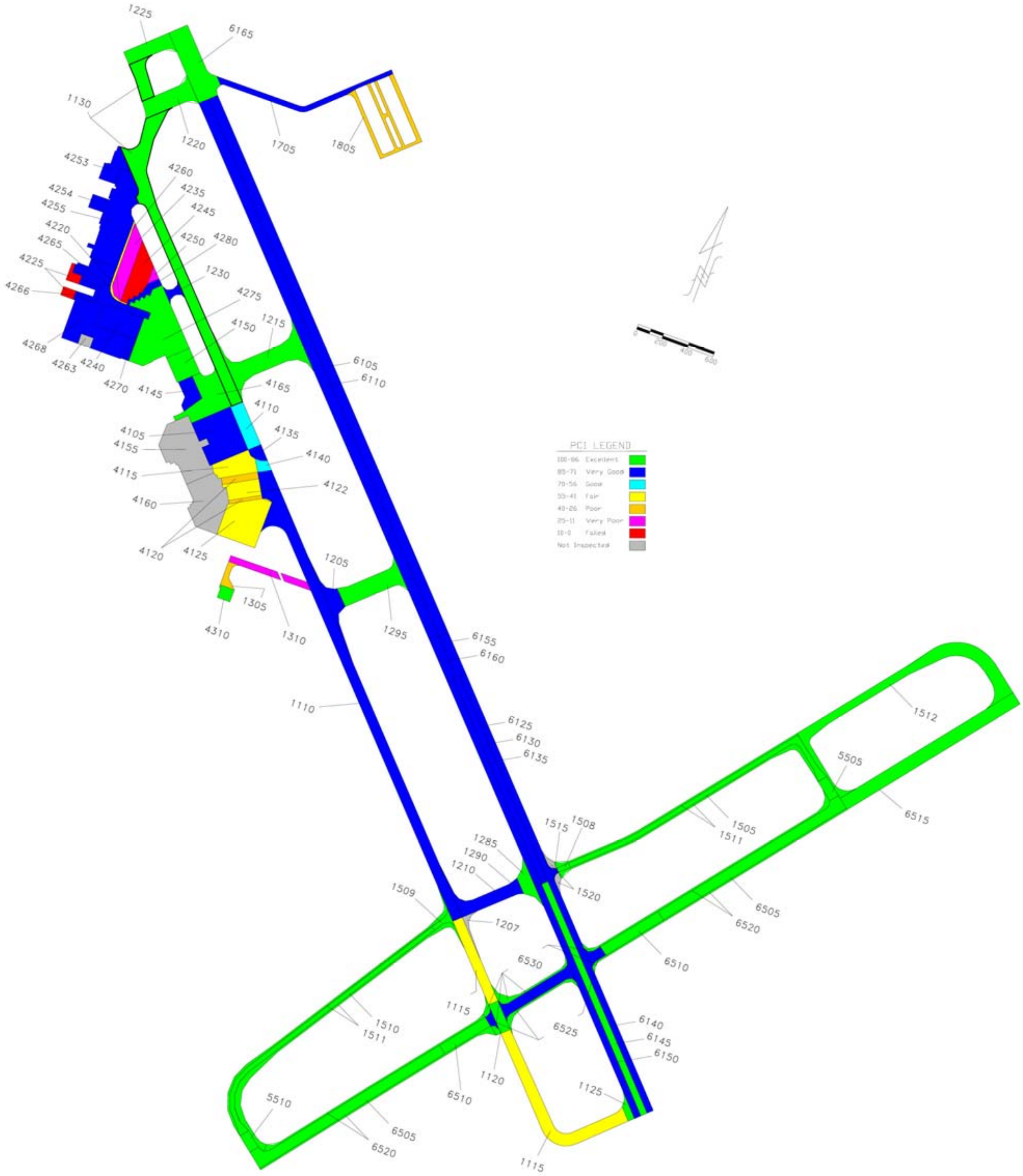
A pavement condition evaluation is a visual analysis of the primary distress manifestations exhibited on the surface of a pavement. It serves as an indicator of pavement failure mode and mechanism. The data collected is computed and presented in the form of a pavement condition index (PCI), a numerical rating index.

The pavement condition evaluation for the Airport was prepared in February 2006 and indicated that most pavement was in excellent to very good condition (see Exhibit 3-1). The pavement which was not rated as excellent or very good consists of:

- Service Road leading west from Taxiway Exit C4 to the ARFF, which was rated poor and very poor
- Southern half of terminal apron, which was rated fair and poor
- Northern half of general aviation apron, which was rated very poor to failed

It is important to note that the southern section of Taxiway C and exit Taxiway C5 had been rated fair. However, since publication of the pavement condition report, these taxiways have been improved.

Exhibit 3-1
PAVEMENT CONDITION



Source: North Dakota Aeronautics Commission

3.3.3 Taxiway Analysis

The taxiway analysis addresses specific requirements relative to the ability of the existing taxiways to accommodate the current and projected demand. At a minimum, taxiways must provide efficient circulation, have the proper strength, and meet recommended FAA design standards to safely accommodate the design aircraft.

Taxiways are classified as either:

- **Parallel** - these taxiways facilitate the movement of aircraft to and from the runway.
- **Connector** - these taxiways connect the parallel taxiways with the aprons and aircraft storage facilities.
- **Apron Taxiways** - these taxiways provide primary aircraft access on an aircraft parking apron.
- **Apron Taxilanes** - these taxilanes provide access to individual aircraft parking positions and/ or hangar areas.
- **Exits** – these taxiways provide a means of entering and exiting the runway (does not include those taxiways designated as connector, parallel, or apron edge taxiway).

The Airport currently has a sufficient system of taxiways to facilitate general movement on

3.3.3.1 Design Standards

The airport design aircraft determines taxiway design standards and dimensional criteria. Since Bismarck Airport has been built to Design Group IV standards, it is recommended that critical airfield taxiways also be designed and built to the standard FAA Design Group IV taxiway parameters. See Table 3-11.

Table 3-11
TAXIWAY DESIGN STANDARDS

	Design Group	Taxiway	
	IV	C	D
Centerline Separation			
Runway to Taxiway	400	400	400
Taxiway to Taxiway	215	NA	NA
Taxiway Width	75	75	60
Taxiway Shoulder Width	25	0	0
Taxiway Safety Area Width	171	171	171
Taxiway Object Free Area Width	259	259	259

Source: FAA Advisory Circular 150/5300-13

With the exception of Taxiway D width, both taxiways comply with the recommended design standards for ARC D-IV.

SHOULDERS

Taxiway shoulders are typically provided to support aircraft that may inadvertently run off the primary pavement, to improve drainage, and/or provide erosion protection control. The Airport's taxiways do not have shoulders. It is recommended that shoulders be added at the time of taxiway reconstruction or improvement.

3.3.4 Airfield Electrical Service

The existing electrical vault is located adjacent to the recently constructed terminal. Its location encroaches on the air carrier apron and limits expansion. It is recommended that the electrical vault be relocated during Planning Activity Level 1.

3.3.5 Airfield Signage

The FAA recommends that all airports install a system of runway and taxiway guidance signs in accordance with the standards found in FAA Advisory Circular 150/5340-18C, *Standards for Airport Signage Systems*. Guidance signs include mandatory holding position signs for runway/runway and runway/taxiway intersections, ILS critical areas, and runway approach areas. Additional taxiway guidance signs include runway and taxiway location, runway exit, taxiway direction, inbound/outbound destination, and information signage. The signage plan for the Airport was completed in 2006 and is filed with the FAA.

3.4 AIRSPACE

The national airspace system consists of various classifications of airspace that are regulated by the FAA. Airspace classification is necessary to ensure the safety of all aircraft utilizing the facilities during periods of inclement weather.

3.4.1 Capacity Enhancements / Operational Efficiency

The current Class D Airspace is adequate for the existing and future operational requirements expected at the Airport. When the ATCT is not in operation between 12AM and 6AM, Class E Airspace applies and is adequate for the existing operational requirements. At the time that there is a significant increase in cargo activity the adequacy of the Class D airspace and part time tower will need to be revisited. A significant increase in cargo activity could demand a 24-hour operational tower.

3.4.2 Navigational Aids

NAVAIDs consist of equipment that helps pilots locate the Airport and provides horizontal or a combination of horizontal and vertical guidance information. The runways have appropriate navigational aids that are properly sited and in working condition. Both ends of Runway 13/31 have an ILS that utilizes glide slope, approach lighting systems, and localizers. Runway 13 and Runway 31 meet Category I landing requirements, which require ceilings above 200 feet and visibility greater than 1/2 statute miles.

In addition to the traditional ground based approaches currently in place at Bismarck Airport, the Airport is awaiting release of wide area augmentation system (WAAS) localizer performance with vertical (LPV) instrument approaches. These approaches are the equivalent of ground based ILS approaches. The first LPV approach for Bismarck Airport is slated for Runway 21.

3.4.3 Visual Aids

Visual aids enhance the pilot's visual information when visibility is poor and at night, it is essential to provide visual aids that will be as meaningful to a pilot as possible. These aids can provide pilots information based on their horizontal and vertical position by providing data regarding the aircraft's alignment, height and distance, rotation, and information concerning the rate of descent and the rate of closure with the desired path. The visual aids at the Airport include runway lighting, rotating beacon, threshold lights, visual approach slope indicator (VASI), precision approach path indicator lights (PAPI), and runway end identifier lights (REIL). With the exception of the VASI, all of the existing visual aids are in serviceable condition and need only routine maintenance.

The VASI system at the Airport consists of four bars that appear to project a red or white light depending on the position of the aircraft in reference to the glideslope. Runway 13 is equipped with visual approach slope indicator system (VASI-4) to provide visual descent guidance to the runway. PAPIs are the current standards for visual descent guidance and are already installed on Runways 3, 21, and 31. The FAA is currently scheduled to replace the VASI on Runway 13 with a PAPI.

3.5 PASSENGER TERMINAL

Passenger terminal facilities at the Airport include the terminal building, terminal curbfront, main aircraft gate positions, and commercial service apron. These areas are specifically designed to serve passengers utilizing commercial airline service at the Airport.

Given that the terminal is new and well designed to accommodate current needs, this section evaluates at a high level the future ability of the existing passenger terminal building to accommodate the forecast commercial service operations and enplanements. The critical forecast demand areas include the aircraft gates, terminal curbfront, and vehicle parking availability. A brief discussion of the terminal building is provided below, followed by detailed analysis of the aircraft gates, apron, terminal curbfront, and vehicle parking.

3.5.1 Terminal Building

The terminal building at Bismarck Airport was constructed in 2005 and is anticipated to meet the activity demand throughout the planning horizon. As such, no new expansion efforts are anticipated. However, the Airport has expressed a need for the establishment of Federal Inspection Services (FIS).

3.5.2 Aircraft Gate Positions

The terminal provides flexibility for accommodating a variable fleet mix and currently provides parking for regional jet, narrowbody, and widebody (accommodated on Gate Number One only) aircraft. The current configuration provides for four aircraft parking positions, served by three passenger loading bridges. Given the Air Transport Association's guidance that a gate should accommodate between four and six departures per gate per day, Bismarck Airport meets the current demand and no additional gates are needed at this time.

3.5.2.1 Existing Gates

Bismarck Airport accommodates a variety of aircraft, including regional jets, narrowbody, and widebody aircraft (see Table 3-12). Gate 1, located on the southern side of the terminal building, can accommodate aircraft ranging in size from a regional jet to a widebody. Gate 2, the southern gate on the face of the building, and Gate 3, the northern gate on the face of the building, can accommodate aircraft ranging in size from a regional jet to a large narrowbody. The passenger loading bridge located at Gate 3 serves two aircraft parking positions.

Table 3-12
EXISTING GATE DEMAND AND CAPACITY

Aircraft Size Categories	Typical Aircraft	Gate Count		
		Demand	RON[1]	Existing
Turboprop	Dash 8	0	0	0
Small Regional Jet	CR200	1	1	0
Large Regional Jet	CR700	0	0	0
Small Narrowbody	B737-300, DC-9	0	1	0
Large Narrowbody	A320, B737-800, B757	2	1	3
Widebody	B767	0	0	1
Total		3	3	4

[1] RON (Remain Over Night)

Gate frontage is a measure of the linear length along the terminal within which aircraft may be parked and is an additional measure of gate capability for the existing terminal. The gate frontage demand is a function of the quantity and types of aircraft parked at the terminal at a given time, and the space required for each aircraft. A comparison of the available gate frontage relative to the demand offers a measure of gate utilization.

The gate frontages required by the existing peak hour demand and remain over night (RON) aircraft are 351 feet and 331 feet, respectively, and are shown in Table 3-13. This table also shows the existing terminal apron configured for the parking of four large narrowbody aircraft, and the associated frontage of 532 feet. The total available gate frontage at Bismarck Airport as measured along the face of the concourse is approximately 438 feet. However, as aircraft parking at the terminal wraps around the building, the available frontage is not simply the 438 foot distance along the face of the building. Instead, the available frontage is based on the ability to park additional aircraft wrapping around the building corners, and the actual available frontage is 668 feet.

Table 3-13
EXISTING GATE FRONTAGE DEMAND

Aircraft Size Categories	Wingspan (LF)	Gate Count			Frontage (LF)		
		Demand	RON	Existing	Demand	RON	Existing
Turboprop	70	0	0	0	0	0	0
Small Regional Jet	85	1	1	0	85	85	0
Large Regional Jet	92	0	0	0	0	0	0
Small Narrowbody	113	0	1	0	0	113	0
Large Narrowbody	133	2	1	3	266	133	399
Widebody	160	0	0	1	0	0	160
Total		3	3	4	351	331	559

3.5.2.2 Future Gate Requirements

Three forecasts of peak hour operations were developed in Chapter 2, Aviation Demand Forecasts, and defined as planning activity levels. These forecasts are based on a growth in the number of airlines serving the Airport, an increase in markets served, or a combination thereof.

The facility requirement analysis is based on peak hour operations equaling approximately 80 percent of the peak hour arrivals and departures, and peak hour gate requirements equaling approximately 75 percent of peak operations. Table 3-14 shows that at the forecast operation levels, the daily gate utilization is five to six turns per day. Air Transport Association guidance indicates that gate utilization rates between four and six departures per gate per day are considered good utilization. The recommended gate sizes for the forecast demand are shown in Table 3-15.

Table 3-14
FUTURE GATE REQUIREMENTS AND UTILIZATION

		Planning Activity Level		
	2005	**1**	**2**	**3**
Average Day Operations	30	32	34	38
Peak Hour Departures	3	3	3	4
Peak Hour Arrivals	3	3	3	3
Peak Hour Operations	3	3	3	4
Number of Gates	3	3	3	3
Utilization				
Per Day	5	5	6	6
Per Hour	1	1	1	1

Table 3-15
FUTURE OPERATIONAL GATE SIZE REQUIREMENTS

Aircraft Size Categories		Planning Activity Level		
	2005	**1**	**2**	**3**
Turboprop	0	0	0	0
Small Regional Jet	1	2	1	0
Large Regional Jet	0	0	1	2
Small Narrowbody	0	0	0	1
Large Narrowbody	2	1	1	1
Widebody	0	0	0	0
Total	3	3	3	4

The gate frontage requirements associated with the forecast operation fleet mix demand are presented in Table 3-16. During Planning Activity Level 2 and 3 the gate utilization is forecast to reach the high end of the recommended guidance of six departures per gate per day and it is recommended that planning occur to provide additional gates. The existing terminal has sufficient frontage to accommodate the forecast growth under all three planning activity levels; therefore, it is recommended that the planning for additional gates consist of a realignment of the existing aircraft parking and gate positions to accommodate the increased demand.

Table 3-16
FUTURE GATE FRONTAGE REQUIREMENTS

Aircraft Size Categories	Wingspan (LF)	2005	Planning Activity Level		
			1	2	3
Turboprop	70	0	0	0	0
Small Regional Jet	85	85	170	85	0
Large Regional Jet	92	0	0	92	184
Small Narrowbody	113	0	0	0	113
Large Narrowbody	133	266	133	133	133
Widebody	160	0	0	0	0
		351	303	310	430

3.5.3 Apron

Frontage associated with the terminal gates is a measure of the linear feet of terminal apron interface needed. This dimension can vary as a function of the gate operational mode (i.e. power-in/power-out versus power-in/push-out) and the minimum wingtip clearances between aircraft. Industry standards for wingtip clearances are:

- Turboprops and regional jets = 10 feet
- Narrowbody and B757 = 20 feet
- Widebody and larger = 25 feet

The gate frontage, discussed in detail in the preceding section, is a dimension measured across the face of the terminal within the aircraft parking area. This dimension indicates the number of aircraft that can be parked at the same time. The total gate frontage available at Bismarck Airport is 668 linear feet, of which 438 linear feet is prime frontage and the remaining 230 feet is located on the sides of the terminal building. Future gate frontage requirements, identified in Table 3-16, require only 430 linear feet of frontage.

An additional measure of the ability for a terminal apron to accommodate forecast growth is the depth of the apron. In addition to aircraft length, clearance from service roads within the aircraft parking must be accounted for. Typically clearance from service road area is 10 feet for all aircraft types. The existing apron depth at Bismarck Airport is 453 feet, excluding Taxiway C and the associated object free area. The largest widebody aircraft is approximately 230 feet. Therefore, with the addition of the 10 foot service road, the apron provides an additional 213 feet of depth, more than adequate for the forecast demand.

3.5.4 Terminal Curbfront

The terminal curbfront at Bismarck Airport was reconstructed in 2005. The existing curbfront is configured as six at-grade lanes, all one directional with 16-foot lane widths. The inner circulation loop has four lanes servicing departures and arrivals. The inner lanes are used for loading and unloading passengers and the outer two lanes are used as through lanes. The outer circulation loop has two lanes servicing taxis and shuttle vans, the inner lane is used for passenger loading and unloading and the outer lane is used as a through lane. The inner four lanes and outer two lanes are separated by a curbed median. The frontage allocation is shown in Table 3-17.

Table 3-17
TERMINAL CURBFRONT ALLOCATION

	Inner Curb	Outer Curb
Crosswalk	42	10
Effective Length	558	250
Total Length	600	260

A total physical length of 600 feet is available on the inner curb, including the walkway that extends approximately 140 feet to the west and east of the terminal. The outer curb is approximately 260 feet in length. Excluding the crosswalks, the effective length of the inner and outer curb is 558 feet and 250 feet, respectively. Considering that double parking is possible with the inner curb second lane configuration, an additional 50 percent of effective curb length is available for enplaning or deplaning passenger traffic.

The capacity of the curbfront is estimated using the foot-minute concept. This method reflects the dynamic operations uses of curbfront area by vehicles of multiple length and variable dwell times. A summary of the terminal curbfront capacity is provided in Table 3-19.

Table 3-18
TERMINAL CURBFRONT CAPACITY

	Capacity (Vehicles)			Peak 20 Minute Capacity (Vehicles)		
	Single Lane		Dual Lane	Single Lane		Dual Lane
	Inner	Outer	Inner	Inner	Outer	Inner
Enplaning	14	6	17	14	6	17
Deplaning	14	6	17	14	6	17
Total	28	13	34	28	13	34

	Hourly Capacity (ft-min)			Peak 20 Minute Capacity (ft-min)		
	Single Lane		Dual Lane	Single Lane		Dual Lane
	Inner	Outer	Inner	Inner	Outer	Inner
Enplaning	16,740	7,500	25,110	5,580	2,500	8,370
Deplaning	16,740	7,500	25,110	5,580	2,500	8,370
Total	33,480	15,000	50,220	11,160	5,000	16,740

Vehicle demand for curbfront space tends to surge within an hour time frame, creating peaking that coincides with typical movements associated with passenger enplanements and deplanements. However, the surges are limited in time and abate quickly. In addition, security procedures limiting the permitted dwell time of curb vehicles has had a positive effect on curbfront operations.

Based on the available terminal curbfront capacity, the terminal curbfront demand capacity is shown in Table 3-19.

Table 3-19
TERMINAL CURBFRONT DEMAND CAPACITY

Curb	2005	Planning Activity Level		
		1	2	3
Peak Hour				
Enplaning	11.2%	12.7%	14.5%	18.3%
Deplaning	11.2%	12.7%	14.5%	18.3%
Peak 20 Minutes				
Enplaning	16.7%	19.1%	21.7%	27.5%
Deplaning	16.7%	19.1%	21.7%	27.5%

As a result of the surge characteristics, the peak 20-minute relationship is the more important indicator of requirements than the peak hour relationship, and it is a better basis for the definition of facility requirements. The enplaning curb presently operates at 17 percent of capacity. It is forecast to increase to 28 percent by the third planning activity level and will remain adequate. Similarly, the deplaning curb is presently operating at approximately 17 percent capacity. The deplaning curb is forecasted to increase to 28 percent by the third planning activity level, and will also remain adequate.

Since the walkway between the terminal and the terminal curb extends approximately 140 feet to the west and east of the terminal, an analysis of only the 320 feet of inner curbfront immediately south of the terminal was also undertaken. In brief, the existing peak 20-minute terminal curbfront demand capacity would still be acceptable at 37 percent. By Planning Activity Level 3, the demand/capacity ratio is approximately 55 percent.

3.5.5 Vehicle Parking

In order to determine the future parking requirements a ratio of parking spaces per enplanements has been utilized. The industry norm for medium to small hub airports is a ratio of 3.5 to 4.0 spaces per 1,000 enplanements. Several factors, such as the high percentage of passengers driving to Bismarck Airport, lack of private off-airport parking, and lack of mass transit availability affect the standard ratio. Therefore, for the purposes of facilities planning the higher ratio of 4.0 spaces per 1,000 enplanements is applied to determine existing and future parking requirements.

As an additional consideration, each parking area is assumed to have a maximum utilization rate of 90 percent. This utilization rate, which is also an industry norm, is intended to avoid excessive circulation of vehicles in search of parking. Therefore, the maximum 90 percent utilization has been applied to each planning activity level.

Based on the passenger forecast for annual enplanement levels, the existing parking capacity is not capable of supporting the forecast demand. The existing and future parking demand levels for the passenger forecast are shown in Table 3-20.

Table 3-20
VEHICLE PARKING

	2005	Planning Activity Level		
		1	2	3
Annual Enplanements	173,738	198,300	225,100	284,700
Public Parking				
Required	764	873	990	1,253
Available	518	518	518	518
Additional Needed	246	355	472	735
Employee				
Required	78	89	101	128
Available	78	78	78	78
Additional Needed	0	11	23	50
Total				
Required	842	962	1,091	1,381
Available	596	596	596	596
Additional Needed	246	366	495	785

Note: An additional 77 parking spaces were added in 2007.

The difference in the number of short-term and long-term parking spaces typically varies between 10 to 20 percent. The short-term parking ratio at Bismarck Airport, including the additional 77 parking spaces added in 2007, is 32 percent of the total spaces. The increased ratio is a result of the Airport providing 20 minutes of free parking in the short term parking lot to aid passenger pick up and drop off. Therefore, to maintain the same level of service, it is recommended that the Airport continue to provide a similar short-term parking ratio of 30 percent. The forecast number of required short-term spaces and long-term sparking paces is provided in Table 3-21.

Table 3-21
SHORT AND LONG-TERM PARKING REQUIREMENTS

	2005	Planning Activity Level		
		1	2	3
Total Parking Required	764	873	990	1,253
Short-Term Parking				
Required	229	262	297	376
Available	193	193	193	193
Additional Needed	36	69	104	183
Long-Term Parking				
Required	535	611	693	877
Available	325	325	325	325
Additional Needed	210	286	368	552

Since both short and long-term parking is inadequate throughout the planning horizon for the passenger forecast, it is recommended that the Airport begin planning for additional parking expansion in the immediate future to accommodate the current demand, as well as prepare for the forecast increase in enplanement levels.

3.6 GENERAL AVIATION

General aviation itinerant and based aircraft facility requirements at an airport primarily consist of fixed base operator services, hangar storage, and apron space. Future facility requirements require an analysis of the existing and future general aviation operations, based aircraft levels, and the capacity and condition of existing facilities.

3.6.1 Fixed Base Operators

The current provision of services to general aviation is considered sufficient to meet existing demand. However, business opportunities exist to provide differing types of FBO services than those that are currently provided at the Airport. It is recommended that the Airport identify sites suitable for additional FBO development.

3.6.2 Hangars

The amount of general aviation hangar space required at an airport is often a function of the local weather conditions, aircraft type, airport security, and user preference. Airports that experience moderate weather conditions generally store less than 20 percent of the based aircraft in hangars. Airports that experience extreme weather conditions, such as severe winter temperatures and precipitation, generally store greater than 80 percent of the based aircraft in hangars.

The smaller single-engine aircraft and light multi-engine aircraft may be stored in individual t-hangar units. However, conventional hangars, which can vary in size from small box hangars to large corporate hangars, are capable of storing multiple aircraft.

Nearly 100 percent of all based aircraft at Bismarck Airport are stored in either conventional or t-hangars. Analysis conducted to determine the number and type of hangar facilities required assumed that the existing ratio of aircraft in hangars would remain consistent throughout the planning period and that based aircraft covered storage will continue to consist of a combination of conventional and t-hangars. At Bismarck Airport, on average, each conventional hangar stores an average of six single or multi-engine aircraft, or three jets. The forecast facility requirements are shown in Table 3-22.

Table 3-22
GENERAL AVIATION HANGAR REQUIREMENTS

	2005				Planning Activity Level											
					1				2				3			
	SEP	MEP	Jet	Total	SEP	MEP	Jet	Total	SEP	MEP	Jet	Total	SEP	MEP	Jet	Total
Total Based Aircraft	51	13	7	71	66	15	8	74	67	18	9	78	68	22	13	86
Based Aircraft in Hangars	48	12	7	68	63	14	8	85	64	17	9	90	65	21	13	99
T-Hangar:																
Required Units	9	0	0	9	14	0	0	14	14	0	0	14	14	0	0	14
Total Available Units				10				10				10				10
Total Additional Units Needed				0				4				4				4
Conventional Hangars[1]:																
Required Units	7	2	2	11	8	2	3	13	8	3	3	14	8	3	4	16
Total Available Units				10				10				10				10
Total Additional Units Needed				1				3				4				6

[1] Assumes six SEP/MEP or three jet aircraft per conventional hangar.

Based on this assumption, four additional t-hangars and additional conventional hangars will be needed to accommodate additional aircraft by Planning Activity Level 3. Although this analysis assumes that each conventional hangar will store six propeller or three jet aircraft, it is important to note that conventional hangars may be built to accommodate more or less than these quantities. Therefore, the conventional hangar size and capacity numbers are dependent upon the tenants demand requirements.

3.6.3 Apron

Existing general aviation aircraft apron at the Airport consist of various areas for parking, aircraft tie-down, circulation, and general aircraft movement to and from parking and storage hangars. Demand for general aviation apron space is driven by itinerant aircraft and based aircraft not desiring hangar storage. Determination of future general aviation apron requirements necessitates an assessment of the general aviation aircraft fleet mix, daily aircraft parking demand, and space planning considerations. Apron sizing for tie-down positions varies according to the aircraft size and also includes space for circulation.

The general aviation apron located north of the commercial passenger terminal provides approximately 62,000 square yards of usable apron. Based on the general aviation demand forecast for both based and itinerant aircraft, no additional general aviation aircraft apron is required throughout the 20-year planning horizon. However, as aircraft user types are segregated on the airfield it will be necessary to construct additional apron space to accommodate new hangar development.

3.6.3.1 Pavement Strength

Existing general aviation aprons are predominantly rigid pavement; however the areas of flexible pavement are in poor to failed condition and are scheduled for removal/replacement. The rigid pavement apron areas have pavement strengths sufficient to support 60,000 pound single wheel or 75,000 pound dual wheel aircraft.

3.7 NORTH DAKOTA ARMY NATIONAL GUARD

The North Dakota National Guard facilities are adequate at the current time and no future expansion is anticipated.

3.8 AVIATION SUPPORT FACILITIES

Support facilities at an airport encompass a broad set of functions that exist to ensure the smooth and efficient operation of an airport's primary role and mission. Support facilities at Bismarck Airport include:

- Rental cars
- Aircraft rescue and fire fighting
- Airport maintenance and snow removal equipment storage
- Intermodal and cargo facilities
- Airport fuels
- Air traffic control tower
- Utilities
- Storm water pollution prevention
- Fencing

3.8.1 Rental Cars

The required rental car demand fluctuates based upon passenger demand and time of year. Historical estimates indicate that approximately seven percent of all enplanements utilize rental cars. This historical rate is applied to the average day enplanements to determine the ready/return lot parking space demand. Table 3-23 provides the projected rental car parking demand for the forecast of annual enplanements. Additional ready/return lot parking space is needed by the first planning activity level. It is recommended that the Airport begin planning for additional parking.

Table 3-23
RENTAL CAR PARKING DEMAND

	2005	Planning Activity Level		
		1	2	3
Annual Enplanements	173,738	198,300	225,100	284,700
Average Day	565	645	732	926
Peak Hour	140	160	182	230
Average Day				
Demand	266	304	345	436
Available	266	266	266	266
Additional Needed	0	38	79	170

In addition to the ready/return lot, the Airport is designing and constructing a consolidated rental car service area. This area will be utilized to service rental cars; including washing facilities, fueling, and storage.

3.8.2 Aircraft Rescue and Fire Fighting

Airports that serve scheduled and unscheduled air carrier flights are required to provide aircraft rescue and fire firefighting (ARFF) facilities and equipment. For FAR 139 certified airports, ARFF equipment requirements are identified by an airport's index ranking. The length of the largest air carrier aircraft operating at the airport and the number of daily departures conducted by the aircraft determines the index.

The ARFF facility and equipment at Bismarck Airport currently meet FAA Index B criteria in terms of the capacity of the equipment and staffing defined in FAR Part 139.315, *Aircraft Rescue and Firefighting: Index Determination*. FAR 139 requires the Airport to have either one of two vehicles available. If one vehicle is available, then it must be able to carry at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of aqueous film forming foam (AFFF) for foam production.

If there are two vehicles available, then one vehicle is required to carry either 500 pounds of sodium-based dry chemical, halon 1211, or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of AFFF to total 100 gallons for simultaneous dry chemical and AFFF application. The second vehicle is required to carry an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons. Based on current required facility improvements, the Airport will continue to need to meet the FAA Index B criteria.

The ARFF building consists of two sides, the personnel side and the vehicle side. The personnel side contains a kitchen, living and dining space, sleeping quarters, and offices. The vehicle side has three bays for indoor vehicle parking and maintenance. Vehicles parked in these bays include one 3,000 gallon Oshkosh Airport Rescue trucks, one 1,500 gallon Oshkosh Airport Rescue truck, and an SUV.

The Airport plans to procure a telescoping snorkel truck, which will necessitate adding a bay on the vehicle side of the ARFF building. During the addition, upgrades should be made to the existing vehicle side. The present condition is not in compliance with OSHA regulations, especially as they pertain to venting of vehicle exhaust inside the building. Also, the doors are too small for today's larger ARFF vehicles and should be replaced with larger doors. On the personnel side of the building, another office is needed, for airfield operations. It is recommended that the Airport begin planning for these improvements in the short-term.

3.8.3 Airport Maintenance

The demand for airport maintenance facilities is directly related to the amount of pavement, lighting equipment, terminal building size, and overall grounds maintenance that is required by the Airport. It can be assumed that as the airfield and/or facilities increase in size, the existing maintenance facility may require expansion or relocation.

Currently, the Bismarck Airport has fewer pieces of snow removal equipment than recommended by the FAA's calculation method. Table 3-24 compares the current equipment with the recommended existing and future equipment level. The future represents the recommended runway extension previously identified. In addition, to the existing equipment listed, the Airport has one runway sander, one runway de-icer truck, and one plane de-icer/boom truck. Along with the snow removal equipment, the Bismarck Airport has two 15-feet rotary mowers/tractors. These are used for maintaining grass and landscape areas.

Table 3-24
AIRPORT MAINTENANCE EQUIPMENT

Equipment	Existing	FAA Allowance		Difference	
		Existing	Future	Existing	Future
Snow Blower	2	4	6	2	4
Plow	6	8	12	2	6
Sweeper	2	6	7	4	5
Loader	1	1	2	0	1

All of this equipment is stored in the maintenance facility. This facility exceeds its design capacity with the storage of existing equipment. To accommodate the existing equipment, the plows have to be parked side-by-side, alternating nose-in rear-in to get them to fit. If the Airport acquires any additional equipment, this maintenance facility would not be able to contain it.

In addition to exceeding its storage capacity the facility has other operational and safety deficiencies which included:

- Inadequate ventilation is a concern with exhaust fumes and welding fumes.
- Lack of a sand/oil separator is a concern because the floor drain allows oil and sand to enter directly into the public sanitary sewer system.
- Inadequate lighting makes repairing equipment extremely difficult.
- The inefficient arrangement of floor space means the uses of the building are limited and use of the building is not optimal.

Therefore, it is recommended that the Airport continue to obtain additional maintenance equipment as needed and, in doing so, construct a new maintenance storage building that can adequately store all recommended equipment and provide a safe operational environment. It is recommended that the airport obtain the additional maintenance equipment as funding becomes available and demand warrants.

3.8.4 Cargo

Air cargo service is currently provided by DHL, FedEx, UPS, Integrated Commercial Solutions (ICS), and the United States Postal Service. Cargo is flown primarily by contract carriers for each of these major service providers. Cargo loading, off-loading, and, in some cases, sortation is conducted on the general aviation apron. This process involves the movement of cargo vehicles on the apron mixing with general aviation activities. To enhance safety of the general aviation community and the cargo operators, it is recommended that the cargo operations are segregated from the general aviation activities.

The Transportation Security Administration (TSA) recently enacted rules requiring specific air cargo operations to occur in Secure Identification Display Area (SIDA). These rules require all persons in a pre-designated cargo area to have proper security clearance and identification badges and only permits cargo activity to occur in that area. Although the current criteria of these rules do not include cargo operations at Bismarck due to existing aircraft used, this Master Plan anticipates that future operations at Bismarck will be subject to these rules and, therefore, recommends identification of a separate, secure cargo area. It is recommended that the segregation of cargo activity occur in the short-term.

The forecast of cargo activity considers the potential for future growth of cargo activity in its current mode of operation. Growth will occur through either an additional cargo carrier or expansion of activity by existing carriers, producing 15 to 20 percent growth through the end of the planning period. The facility requirement based on this growth is the provision of six additional aircraft apron position.

The forecast of cargo activity also considers the establishment of a heavy lift/more traditional cargo operation, likely associated with the intermodal function of the NPCC. The NPCC will have direct access to road, rail, and air transportation. Road access is provided via U.S. Interstate 94 and U.S. Highway 83; rail service through Burlington Northern Santa Fe, Canadian Pacific, and the Dakota Missouri Valley & Western Railroads; and passenger, air freight, and cargo transportation service at the Bismarck Airport. Once the NPCC is fully established, one forecast scenario calls for an additional aircraft to be added to each carrier's air-to-truck connecting operation each weekday night (a total of approximately 1,600 annual operations). In terms of a heavy-lift or traditional air cargo operation, the Master Plan envisions a three-aircraft feed to traditional air cargo hubs. The types of aircraft envisioned in this scenario include typical mid to large cargo aircraft such as the B-757-300, B-767-300, and/or A-300. The scenario calls for six daily operations by these example types of aircraft, six days per week (a total of approximately 3,100 annual operations).

Table 3-25 presents the apron space requirements for the existing and future growth scenario considering the existing cargo operation. The table also presents the area requirement based on establishment of a heavy lift/more traditional cargo operation likely associated with the intermodal function of the NPCC.

Table 3-25
CARGO SPACE DEMAND

	Cargo Scenarios		
	Existing	**Traditional Air Cargo**	**Intermodal/ NPCC**
Apron Space (SY)	5,993	15,095	136,000

3.8.5 Airport Fuels

Analysis for future fuel storage requirements requires an analysis of future operational demand and an analysis of how fuel is delivered to the Airport. Airport records indicate an average of 62 gallons of Jet A per itinerant general aviation operation and an average of 81 gallons of Jet A per commercial service operation. The Airport's records of 100LL consumption indicate an average of 18 gallons of 100LL per general aviation operation. These calculations were applied to forecast operations at the Airport and the future fuel requirements determined are as shown in Table 3-26.

Table 3-26
FUEL REQUIREMENTS

	2005	Planning Activity Level		
		1	2	3
Total Annual Operations	53,020	56,150	59,320	65,790
100 LL				
Operations	12,413	13,050	13,700	15,110
Gallons	251,182	240,995	252,999	279,037
Three-Day Storage Capacity	2,285	2,400	2,520	2,780
Available Storage	34,000	34,000	34,000	34,000
Additional Storage Needed	0	0	0	0
Jet A				
Operations	36,622	39,110	41,630	46,690
Gallons	2,474,285	2,564,549	2,728,525	3,058,001
Three-Day Storage Capacity	23,950	25,560	27,200	30,480
Available Storage	85,000	85,000	85,000	85,000
Additional Storage Needed	0	0	0	0

Typical planning guidelines for fuel storage units recommend a two- to seven-day storage capacity. It is recommended that the fuel storage capacity for the Airport provide enough storage for three days of operations. Given a three-day storage capacity at the current fuel flowage volumes, a total of 990 gallons of storage capacity for 100LL and 23,950 gallons of Jet A is required. The current storage capacity exceeds this requirement and, based on the planning forecast, the current three-day storage capacities for 100LL and Jet A are sufficient throughout the planning period.

3.8.6 Air Traffic Control Tower

The existing air traffic control tower (ATCT) has a height of 78 feet above ground level. The tower serves as a combination terminal radar approach control (TRACON) and ATCT, commonly referred to as a TRACAB. The tower is beyond its structural life span. The tower cab is also at its control equipment capacity. Due to the age, inability to accommodate additional equipment, and line-of-sight problems to the north end of Taxiway C, the need for a replacement ATCT at the Airport has been identified.

In addition to the air traffic control tower, the airport surveillance radar, a system used to detect and display the position of aircraft in the terminal area, is scheduled to be relocated. The existing site conflicts with the development of the NPCC. The proposed site is located south of Airway Avenue and compatible with planned land use for the area.

3.8.7 Utilities

Utilities provided at the Airport include water, sanitary sewer, gas, electric, storm water drainage, phone, fiber, and cable television. All of the existing utilities are currently adequate to meet the existing demand. However, all of the utilities will need further evaluation coinciding with design and development of recommended improvements at the Airport.

3.8.8 Storm Water Pollution Prevention Plan

A water management plan has been developed for the Bismarck Airport. The airport drainage system was modeled as conditions exist today and as they are projected to exist within the next 10 to 20 years. The system was analyzed to insure that no adverse condition will occur as phased development of the airport property moves forward.

The hydrology and hydraulics of the airport system were analyzed and modeled following FAA manual *Surface Drainage Design* (AC 150/532-5C) and the City of Bismarck's *Storm Water Design Manual.* The use of these two manuals insures that the proposed airport development will not adversely impact airport facilities or downstream properties.

3.8.9 Aircraft Deicing

Airports that commonly experience snow and/or freezing rain, such as Bismarck Airport, should provide designated deicing areas for aircraft in order to facilitate safe and efficient deicing procedures in accordance with environmental regulations. Aircraft deicing is conducted on the terminal and general aviation aprons. Spent deicing fluid and stormwater runoff flow southeast via open ditches and pipe passing under runways and taxiways. While the open ditches facilitate the natural decomposition of the deicing fluids, they also can act as a bird attractant which could result in their removal and the associated need for alternate deicing fluid disposal methods. It is recommended that future apron development include the capability of deicing fluid containment and recycling facilities.

3.8.10 Fencing

Airport perimeter fencing is instrumental to overall airport security. It aids in meeting the security requirements of the Transportation Security Administration (TSA, 49 CFR 1542), complies with Title 14 Part 139 of the Code of Federal Aviation Regulations, *Certification and Operations; Land Airports Service Certain Air Carriers*, and assists in keeping people and wildlife outside of the operations areas on an airport.

The airfield at Bismarck Airport is currently encompassed by security fencing and provides access to the airfield through a series of access control gates. The wildlife fencing is made of chain link and is 10-feet tall around the terminal area and eight feet tall around the other areas of the Airport. The fence is generally in good condition and subject to routine maintenance.

3.9 AIRPORT ACCESS

Airport access systems consist of connecting roadways that enable originating and terminating airport users to enter and exit the airport landside facilities and parking facilities. Surface access is comprised of the following two stages: off-airport access roads and on-airport access roads.

3.9.1 Off-Airport Access

Facility requirements for off-airport access involves a determination of capacity levels associated with the major interstates, highways, and auxiliary roadways provided in the vicinity of an airport.

3.9.1.1 Local Roadway Grid System

Individuals accessing the Airport from the Bismarck metropolitan area generally use the collectors and arterials, which comprise the transportation grid system. Since Bismarck Airport is located approximately two miles due south of the metropolitan area, the Airport can also be easily accessed via Interstate 94 and Bismarck Expressway (Highway 810). Local travelers are familiar with the area and do not need significant signage to reach the Airport, regardless of whether they are traveling along Interstate 94 or Bismarck Expressway. The Airport, in conjunction with the Chamber of Commerce, North Dakota Department of Transportation, and Bismarck City traffic engineer, conducted a study to determine where additional airport signage on major arterials would benefit the community. The results of the study were implemented in 2006. Therefore, access from the grid is considered adequate.

3.9.1.2 Regional Roadways

Regional travel to and from Bismarck Airport is provided predominately via Interstate 94, State Route 83, and the Bismarck Expressway.

EAST-WEST ROUTES

The primary east-west routes include Interstate 94 (I-94), and those routes that serve the area west of the Bismarck metropolitan area and the areas east (towards Fargo). The I-94 interchange at State Street is the most frequently used exit since it provides indirect access to the Airport. State Street, also referred to as University, Drive south of Bismarck Expressway, is a minor arterial that travels south through the Bismarck metropolitan area and connects with the Airport approximately two miles south of I-94.

As supported by the Bismarck-Mandan Metropolitan Planning Organization (MPO) 2006 - 2008 Transportation Improvement Program (TIP) and the Bismarck-Mandan MPO 2011-2030 Long Range Transportation Plan, there are three east-west roadway construction projects scheduled that will significantly improve future local and regional access to Bismarck Airport. The most recent improvement project is on Bismarck Expressway. This four-lane roadway, also designated as a truck route, is scheduled to be reconstructed in the spring of 2009 between 5th Street and Airport Road. Given a 30 to 36-month construction period, this mile-long roadway segment will likely be completed near spring of 2012.

The two long range projects supported by the MPO are at Airway Avenue and Lincoln Road. Airway Avenue is a two-lane road that is located immediately south of the Airport. The mile long segment between Airport Road and Yegen Road is scheduled to be reconstructed sometime before 2030. Lincoln Road is a two-lane road that is located southeast of the Airport. This two mile long segment between Airway Avenue and 66th Street is also scheduled to be reconstructed sometime before 2030.

NORTH-SOUTH ROUTES

The primary north-south routes include State Route 83 and Highway 6. State Route 83 serves the areas north of the Bismarck metropolitan area and the areas south and southeast (towards Fargo). Highway 6 serves the area to the south and southwest of Bismarck Airport. No additional access roads are needed for this route and the current service level is adequate.

As supported by the Bismarck-Mandan 2008-2011 Short Range Transportation Plan and the 2011-2030 Long Range Transportation Plan, there are two north-south roadway construction projects that will significantly improve local and regional access to Bismarck Airport.

26th Street is a two-lane road that is located immediately north of the Airport. The one-mile long construction project will include the construction of an extension across Bismarck Expressway and reconstruction of the roadway. Reconstruction work is expected to begin sometime before 2011.

12th Street is a two-lane road that is located approximately 1.5 miles west of the Airport. The two-mile long construction project between Boulevard and 48th Street is expected to begin sometime before 2030.

3.9.2 On-Airport Access Roads

On-airport access roads are further subdivided into two categories: public and restricted access roads. Public roads are, as the name indicates, available for public use and provide access to general aviation, cargo, military, and commercial service facilities. Restricted access roads are located within airport property and generally provide access to on-airport facilities, such as navigational aids, perimeter fencing, and aprons that cannot be accessed by the general public.

3.9.2.1 Public Roads

Access to the Airport from public roads is adequate and currently operates at an acceptable level of service. Additional public roads should be developed to provide improved access to each of the Airport's four quadrants to facilitate future revenue generating development. Future expansion or modification to these roads is dependent upon other identified airport facility development requirements and is further discussed in following chapters.

3.9.2.2 Restricted Access Roads

It is recommended that the secure airport perimeter service road be extended to provide complete access around the airport perimeter.

3.10 STRATEGIC VISION

It is critical that the City of Bismarck continue to provide for the protection and future expansion of Bismarck Airport beyond the planning horizon identified in this master planning effort in order to ensure the viability of the Airport. As such, it is important that additional revenue generating development associated with the Airport and the community be identified.

The City of Bismarck is developing The Northern Plains Commerce Centre - (NPCC) which is beginning to build on the city-owned Airport Industrial Park located adjacent to Bismarck Airport. The intent of the NPCC will be to become a full service commerce center offering practical location with the ability to reach potential markets anywhere in North America and around the world. The NPCC will become a first-class transportation hub and business park, providing companies that compete in today's global economy with a proficient network of transportation modes, centered on this well thought-out and practical facility. This 243 acre park will have intermodal capabilities with air, rail, and highway service in addition to warehousing and transferring facilities. The NPCC clearly can accommodate all domestic needs; and is to be a gateway to the entire world via air transport.

The objective of the NPCC is to increase the regions ability to compete on a global level due to the ability to ship/import products more competitively. Access to seaports via rail will give companies the ability to use the local labor pool and competitive transportation rates. National and international companies who previously could not locate in Bismarck due to shipping costs caused by the geographic location will now be able to locate in Bismarck and remain competitive in the marketplace.

The NPCC would allow the Airport to pursue this new source of revenue. With NPCC's ability to facilitate the attraction and future retention of large commercial or industrial operations, it is important for the airport to identify entrepreneurial development opportunities both on and near airport property. It is recommended that the development plan for the Airport identify both aviation and non-aviation development areas that are capable of supporting large single and multiple users.

Part of the strategic vision for Bismarck Airport is the ability to not only continue to support the existing domestic air passenger service and air cargo service, but also provide for expanded cargo operations capabilities associated with the NPCC. In order to meet this strategic vision for the Airport, it is necessary to plan for a runway length sufficient for the potential cargo aircraft to conduct non-stop operations to representative domestic and international markets. Consequently, the recommendations within this chapter were developed in conjunction with the NPCC and describe the needs of the Airport above and beyond the minimum required to meet FAA design standards