INTERIM REPORT

ASSESSING WESTERN NORTH DAKOTA'S PRESENT AND FUTURE AIRPORT INFRASTRUCTURES

Submitted on behalf of:

North Dakota Aeronautics Commission

Prepared by:

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NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

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Disclaimer

The author assumes responsibility for any errors of omission, logic, or otherwise. Any opinions, findings, or conclusions expressed in this publication are those of the author and do not necessarily reflect the views of the funding sponsors.

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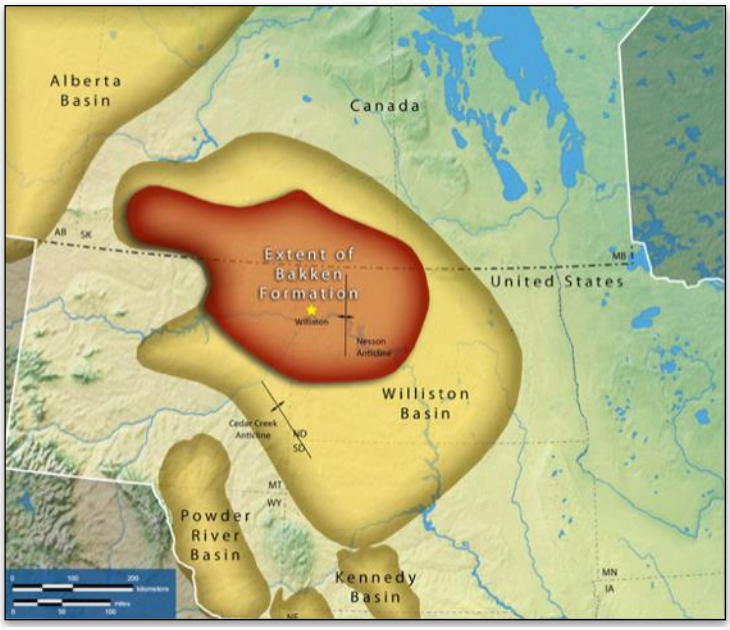
EXECUTIVE SUMMARY

The purpose of this study is to forecast the impact of oil and related economic growth on the air service (airport infrastructure) investment needs in the oil and gas producing regions of North Dakota over the next 10 years. It will provide a framework that will enable policymakers to plan for the future of the state's aviation-related needs. The study has three goals:

(a) Provide information for decision makers developing policies that address the state's aviation needs.
(b) Guide policy makers in long-term financial planning to secure the vitality of the state's aviation systems and services.
(c) Serve as an educational source for the public and industry vested in the state's aviation system on issues that impact commercial and general aviation in North Dakota.

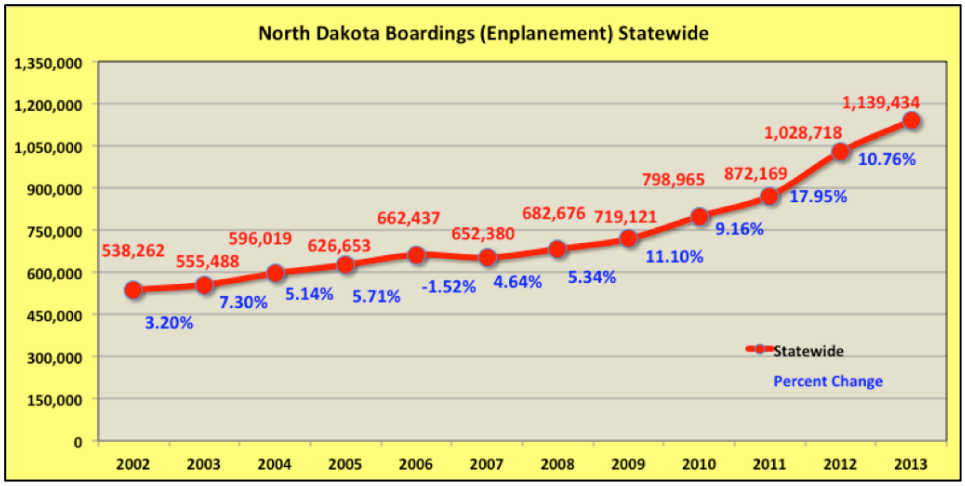
Aviation is a vital part of North Dakota's economy, providing passenger, charter, airfreight, flight training, and agricultural services. In addition, airports facilitate emergency medical transport, search and rescue operations for law enforcement, staging areas for community events such as air shows and support military operations. The industry generates in excess of $1.1 billion in economic activity at the state's 89 public-use airports and an additional $560 million in off-airport activity. Combined, the industry supports over 15,000 jobs and generates an annual payroll of $590 million.



Williston Basin, North Dakota

In recent years, aviation activity has played a critical role in the robust development of the oil and gas industry in North Dakota. Underlying over three-quarters of the state is the Williston Basin, and within the basin lies the Bakken shale. The United States Geological Survey (USGS) estimates the Bakken shale holds approximately 18 billion barrels of crude oil; of which, over 7 billion barrels is extractable. The USGS also estimates that an additional 3.73 billion barrels of recoverable oil lies in a second formation known as Three Forks, which lies below the Bakken shale, increasing the total recoverable oil to over 10 billion barrels. The Department of the Interior (DOI) estimates there is 6,726 billion cubic feet of recoverable natural gas and 527 billion barrels of recoverable natural gas liquid (NGL) in the Bakken and Three Forks formations.

Researchers studying the economic impact of oil and gas extraction and its impact on employment and population have forecast that the industry, which drilled over 7,000 wells in 2012, will continue to expand exploration and extraction activity well into the middle 2030s. Approximately 9,000 wells were drilled in 2013, a 40 percent increase over the previous year. Drilling activity is expected to increase to nearly 39,000 wells by 2036. This increased activity is expected to fuel a demand for passenger and cargo air service and add pressure to the state's aviation system.



North Dakota Passenger Boarding (Enplanement 2002—2013

Airports in all regions of the state report increased passenger and cargo activity. Increased activity diminishes the life cycle of capital assets, including but not limited to runways, taxiways, terminals, parking, and other related infrastructure.

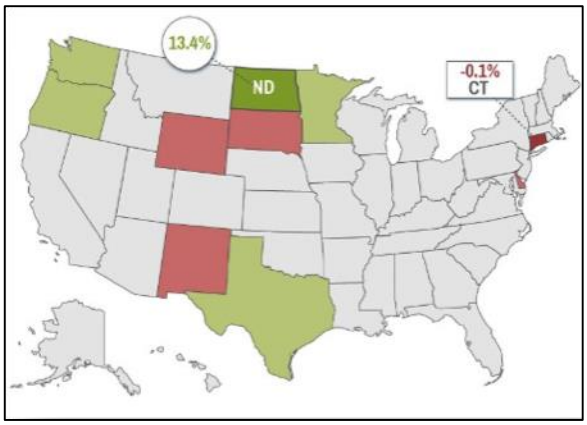
The integrity of airport infrastructure is essential to insure that airports operate safely. Investments in time and money are needed for North Dakota to maintain, repair, and upgrade airport infrastructure, including:

- Constructing new and expanding existing terminals
- Extending and rehabilitating runways, taxiways and aprons
- Acquiring land and equipment
- Installing safety and security measures and removing runway obstructions

From 2013 to 2022, it is estimated that airports in North Dakota will require:

- $857.2 million for capital expenditures.
- Nearly two-thirds or $594 million is needed in the first five years (2013 to 2017)
- The remaining $263.2 million is needed in the second five years (2018 to 2022)
- Airports in the oil-producing regions of Williston, Dickinson, and Minot will require $547.5 million* over ten years
- Airports in the non-oil producing regions such as Bismarck, Fargo, and Grand Forks will require $324.1 million* over the same period

(*Includes capital expenditures for airports not part of the National Plan of Integrated Airport Systems or NPIAS)

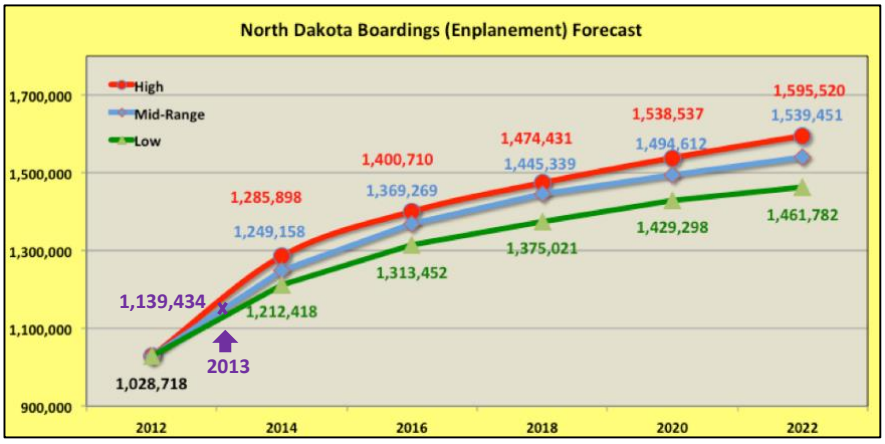


2012 Economic Growth	
North Dakota	13.4 Percent
Texas	04.8 Percent
Oregon	03.9 Percent
Washington	03.6 Percent
Minnesota	03.5 Percent

Propelled by the discovery of oil and gas, North Dakota's economy has a growth rate five times the national average of 2.5 percent, posting a 13.4 percent growth rate in 2012, equivalent to about 38.7 billion. That growth rate is nearly three times as fast as Texas' rate of 4.8 percent, the second highest growth rate in the nation. The production of oil and gas has contributed to an increased demand for air service in the western region of North Dakota, along with spillover effects in the central and eastern areas of the state. In just over a decade, the combined population of the western North Dakota cities of Dickinson, Minot, and Williston grew from 65,476 in 2000 to 81,975 in 2012, a 25.2 percent increase. Similarly, enplanements at the commercial service airports in oil-producing regions grew from 77,645 in 2000 to 283,519 in 2012, an increase of 265 percent.

Due to the speed and magnitude the petroleum activity grew in the oil patch regions, policy makers have had limited opportunities to develop long-term sustainable plans necessary to manage expectations and properly allocate sufficient resources to address long-term development. In addition, policy makers have had limited information about how to manage the current economic boom relative to previous oil booms that produced limited activity relative to the present. Between 2012 and 2022, North Dakota airports are forecast to increase enplanements ranging from 42 percent to 55.1 percent:

- On a low projection rate from 1,028,718 to 1,461,782, an increase by 42 percent
- On a mid-range projection rate to 1,539,451, an increase by 49.6 percent
- On a high projection rate to 1,595,520, an increase by 55.1 percent



North Dakota Boarding (Enplanements) Forecast 2012—2022

Recognizing the unprecedented growth in the oil and gas sectors, the 63rd North Dakota legislature provided a one-time, $60 million funding for airport infrastructure improvements in the oil-producing regions. The state also provided a one-time $6 million appropriation for those airports that would otherwise receive little or no funding. In addition, the state and federal governments addressed the significant increase in airline activity, congestion, and aircraft boarding by providing $40 million for terminal

enhancement as part of a larger capital improvement project, estimated at nearly $70 million at the Minot International Airport.

Research shows that in spite of the increased funding provided by the legislature for the 2013-2014 biennium, North Dakota airports will continue to have financial needs for capital infrastructure projects in excess of current funding levels over the next nine years. It is estimated that the state's aviation systems will need:

- $50 million per year of state funding in addition to federal and local investments
    - State funding would support maintenance and rehabilitation of aviation infrastructure at current and future safety standards, including but not limited to runways, taxiways, terminals, parking, and security
- $5 million per year of state funding for capital projects that are not eligible for federal funding and for those airports that need financial assistance to meet the 10 percent match necessary to secure federal investments

The aviation industry is an essential player in the state's economic vitality. Just as the state highways and roads connect oil and gas production facilities, airports transport travelers and equipment in the oil and gas industry between North Dakota and the rest of the world. As oil and gas production continued to fuel North Dakota's economy, the state recorded an unemployment rate of just 3.3 percent compared to the national unemployment rate of 7.6 percent in February 2013. Continued growth in the state's economy will require increased financial support for air transportation infrastructure, which pays substantial dividends into the state's economic engine.

1. INTRODUCTION

1.1 Aviation

Aviation is the real world-wide web with its network of airlines, airports, and air traffic control organizations that link major cities and small communities of the world. Aviation provides nearly 57 million jobs worldwide and accounts for $2.2 trillion of global gross domestic product (GDP). By 2030, it is estimated that aviation will support nearly 82 million jobs and account for $6.9 trillion of the world's GDP (Air Transport Action Group, 2013).

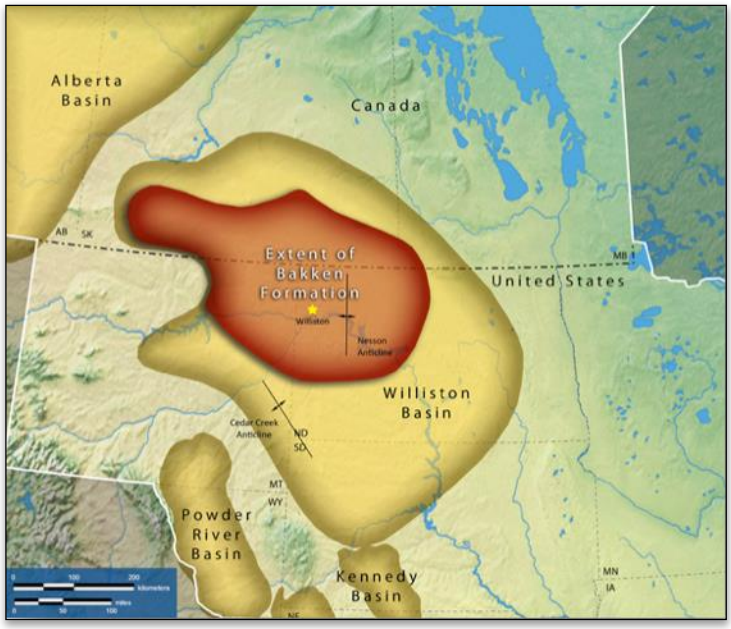


Figure 1.1 Bakken Formation
Source: BDSS, Bakken Decision Support System (2012)

Aviation is also a vital part of North Dakota's economy, providing passenger, charter, airfreight, flight training, and agricultural services. In addition, airports facilitate emergency medical transport, search and rescue operations for law enforcement, staging areas for community events such as air shows and support military operations. In 2010, the industry generated $1.1 billion in economic activity at the state's 89 public-use airports and an additional $560 million in off-airport activity. Combined, the industry supports over 15,000 jobs and generates an annual payroll of $590 million (Wilbur Smith Associates, 2010).

In recent years, aviation activity has played a critical role in the robust development of the oil and gas industry in North Dakota. Underlying over three-quarters of the state is the Williston Basin (Figure 1.1). Within the basin lies the Bakken shale, a rock formation that was deposited approximately 360 million years ago. The formation extends from western North Dakota to northeastern Montana and into Canada's Saskatchewan province. The thickest area of the formation is located southeast of Tioga, North Dakota and the deepest formation is estimated at 15,000 feet near Williston, North Dakota (BDSS, 2013).

The United States Geological Survey (USGS) estimates the Bakken shale holds approximately 18 billion barrels of crude oil; of which, over 7 billion barrels is extractable with current technology (Brown, 2013). The USGS also estimates that an additional 3.73 billion barrels of recoverable oil lies in a second formation known as Three Forks, which lies below the Bakken shale, increasing the total recoverable oil to over 10 billion barrels (Kennedy, 2013). The Department of the Interior (DOI) estimates there is 6,726 billion cubic feet of recoverable natural gas and 527 billion barrels of recoverable natural gas liquid (NGL) in the Bakken and Three Forks formations (Kennedy, 2013).

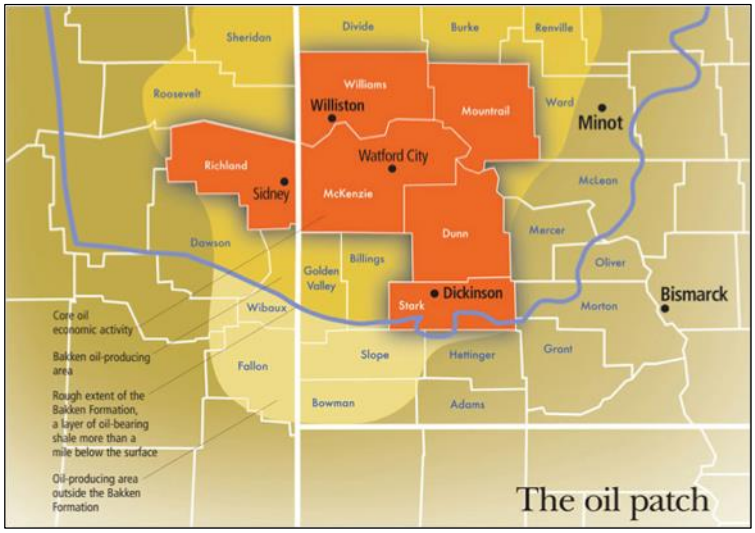


Figure 1.2 The oil patch
Source: The Federal Reserve Bank of Minneapolis, 2013

Oil was first discovered in North Dakota in the 1950s; however, technology had not been developed to extract the resource embedded in the shale formation. In 2008, new drilling technology called hydraulic fracturing came into widespread use (Taylor, 2013). The process uses pressurized liquid to facture layers of rock to release petroleum and natural gas through a wellbore drilled into the rock formation. As of 2010, it was estimated that 60 percent of all new oil and gas wells worldwide were being hydraulically fractured (Montgomery and Smith, 2010). The expansion of oil development associated with shale formations garners local, state, and national headlines. No longer is the rapid development of the oil patch in North Dakota a phenomenon only visible to those working and living in western North Dakota (Bangsund and Hodur, 2011). In fact, North Dakota has been a top-10 oil producing state for over a decade. Extraction from the Bakken has helped North Dakota surge past Oklahoma, Louisiana, and Alaska to become the county's second-largest oil producer, after Texas.

The North Dakota Department of Commerce estimates that Williston, North Dakota is the fastest growing city in the United States, serving as that hub of the region's petroleum industry with nearly 200 oilfield service firms (Figure 1.2). Neighboring Watford City had to annex land and extend sewer lines to accommodate its growing population that increased by 47 percent in two years from 1,700 in 2010 to nearly 2,500 in 2012 (North Dakota Demographics, 2013). The city of Dickinson has developed into an oil field service center, while Minot serves as the gateway for the oil companies and construction firms doing business in the oil fields. Bismarck, the state's capital serves as a bedroom community for managers working in the oil and construction industry (The Federal Reserve Bank of Minneapolis, 2013). The explosive growth of the

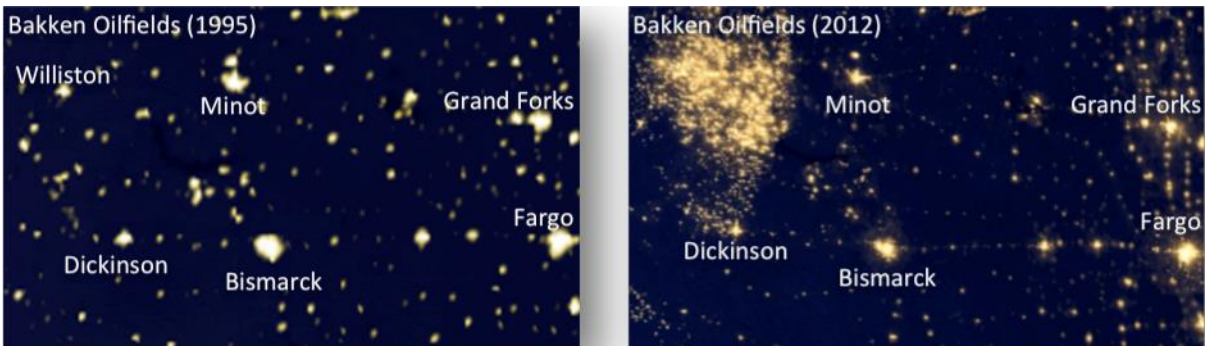


Figure 1.3 Gas flares associated with oil wells in 1995 and 2011 near Williston, North Dakota
Source: NASA, Earth Observatory: City Lights, 2012

petroleum region in North Dakota is illustrated by the images that compare floodlights and natural gas flares associated with oil wells between 1995 and 2012 (Figure 1-3).

In addition to the Bakken shale with an estimated area over 6,522 sq. miles, there are seven other major shale formations (excluding Alaska and Hawaii) in the lower 48 U.S. states (Figure 1.4), including:

- Eagle Ford in Texas with an estimated area of 3,323 sq. miles
- Barnett in Texas with an estimated area of 6,458 sq. miles
- Marcellus in Pennsylvania and West Virginia with an estimated area of 10,622 sq. miles
- Haynesville in Louisiana with an estimated area of 9,000 sq. miles
- Woodford in Oklahoma with an estimated area of 4,700 sq. miles
- Fayetteville in Arizona with an estimated area of 9,000 sq. miles
- Antrim in Michigan, Indiana, and Ohio with an estimated area of 12,000 sq. miles

Figure 1.4 Major shale in the United States
Source: U.S. Energy Information Administration, 2013

Oil and gas production from all eight shale formations grew from 111,000 barrels per day in 2004 to 553,000 barrels per day in 2011, a growth rate of nearly 26 percent. Oil imports to the United States were forecast to fall to their lowest level in 2013 as a result of extraction / production activities in the shale formations (P.C.W, 2013). The U.S. Energy Information Administration (EIA) estimates that gas production will grow faster than consumption, making the U.S. an exporter of natural gas by 2020 (Sieminski, 2013).

Texas's Eagle Ford and North Dakota's Bakken Shale share similar characteristics in size, geography, and the use of fracturing to extract oil and gas. The impacts of extraction and production on transportation, particularly aviation, including but not limited to consequences for airports and related infrastructures, set the stage for an examination of those impacts in two of the largest oil and gas producing states in the United States (Figure 1.5).

Eagle Ford

Figure 1.5 Bakken shale in North Dakota and Eagle Ford shale in Texas
Source: NASA Suomi NPP Satellite, October 2012

The Eagle Ford Shale formation stretches across southern Texas from the Mexican border up into East Texas, measuring approximately 50 miles wide and 400 miles long (Railroad Commission of Texas, 2013). The shale covers a 20 county area (Figure 1.6), including Atascosa, Bee, DeWitt, Dimmit, Frio, Gonzales, Karnes, La Salle, Live Oak, Maverick, McMullen, Webb, Wilson, Zavala, Bexar, Jim Wells, Nueces, San Patricio, Uvalde, and Victoria (Tunstall et al. 2013).

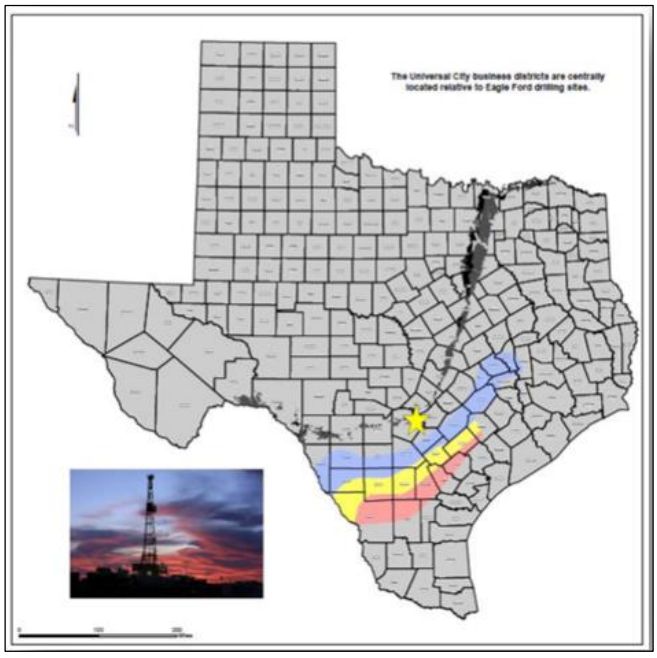


Figure 1.6 Eagle Ford Shale, Southeastern Texas
Source: Universal City.com, 2013

It is estimated that over 116,000 jobs are supported within the 20 county area, producing oil and gas at depths ranging from 4,000 to 14,000 feet. There are approximately 1,262 producing oil leases and 875 gas wells in the region. The shale is named after the town of Eagle Ford, which is located 6 miles west of Dallas, Texas. The first well at Eagle Ford was drilled in 2008 with a daily flow rate of 7.6 million cubic feet of gas per day at a depth of over 11,000 feet (Railroad Commission of Texas, 2013).

There are 29 public use airports within counties in the Eagle Ford region. Among those, 25 are general aviation (GA) airports, including: Alfred D Bubba, Alice, Beeville, Bishop, Boerne, Cotulla-LaSalle, Crystal City, Cuero, Dilley, Dimmit, Garner, Horizon, Hunt, Karnes, Live Oak, Maverick, McKinley, Mustang Breach, Nueces, Pleasanton, Roger M. Dreyer, San Geronimo, Stinson, T.P. Mc. Campbell, and Twin Oaks. The region's four commercial service (CS) airports include: Corpus Christi, Laredo, San Antonio, and Victoria. Between 2009 and 2011

enplanements at the four CS airports in Texas increased from 4,248,192 to 4,422,187 or by 4 percent.

Bakken Shale

The Bakken shale is located in western North Dakota within an 18 county area, including Adams, Billings, Bottineau, Bowman, Burke, Divide, Dunn, Golden Valley, Hettinger, McHenry, McKenzie, Montrail, Pierce, Renville, Slope, Stark, Ward, and Williams (Figure 1-7). Twenty airports are located in the Bakken region, among them 17 are GA airports, including Beach, Bottineau, Bowbells, Bowman, Columbus, Crosby, Hettinger, Kenmare, Killdeer, Medora, Mohall, Mott, New Town, Plaza, Parshall, Richardton, Rugby, Stanley, Tiago, Towner, Watford City, and Westhope. The three CS airports in the region include Dickinson, Minot, and Williston. Between 2009 and 2012, enplanements at the three CS airports increased from 719,121 to 1,022,811 or by 42 percent.

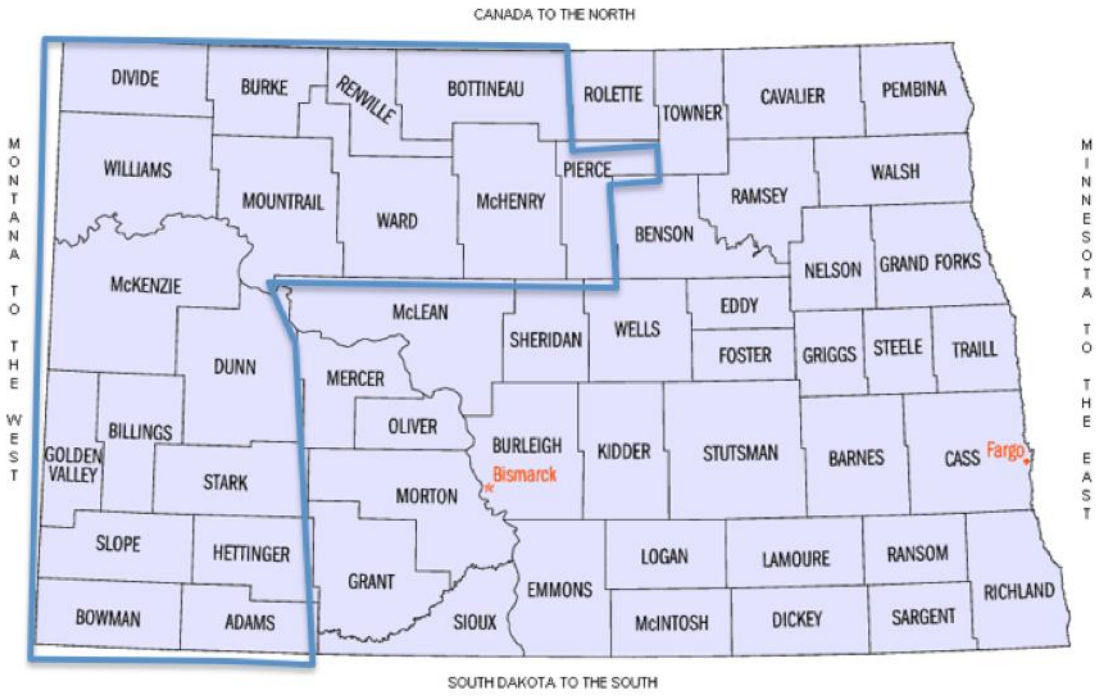


Figure 1.7 North Dakota's Bakken shale covering the western 18-county area of the state
Source: Upper Great Plains Transportation Institute, 2013

Counties within areas of oil and gas extraction report increased surface transportation on state and county roads including trucks hauling drilling rigs, oil field equipment, chemicals, and waste water. It is estimated that a new well requires nearly 1,200 truckload deliveries, traffic equivalent to approximately 8 million cars (Tunstall et al. 2013). In addition, these counties incur damages and increased maintenance costs to surface infrastructure that includes roads, bridges, and pavement resulting from oil and gas production activities. Similarly, increased passenger and cargo activity at airports diminish the life cycle of capital assets, including but not limited to runways, taxiways, terminals, parking, and other related infrastructure (Figure 1.8).

Figure 1.8 Runway at the Sloulin Field International Airport in Williston North Dakota
Source: Flywilliston.net

The integrity of airport pavement is essential to insure that airports operate safely. Investments in time and money are required to maintain, repair, and upgrade airport infrastructure to ensure smooth and effective operations (Hadi et al. 2010). Airport operators have made decisions about infrastructure maintenance and rehabilitation based on needs or experience rather than planning. The Federal Aviation Administration (FAA) determined that such an approach has neither been cost effective or an efficient use of funding resources (FAA Eastern Regional Airport Conference, 2011).

The FAA provides funding for eligible airports to improve runways, taxiways, and aprons by contributing 90 percent of the project cost. To receive federal funds, airports must apply for funding and prepare and maintain an Airport Improvement Program (AIP) that includes:

- Dimensions, locations, and maintenance history of airport infrastructures
- Prescribed inspection schedules that include annual assessments and drive-by observations
- Finding of distress and remedial actions performed,
- Maintain a comprehensive system that is accessible by the FAA (FAA Central Region Airport's Division 2014)

The purpose of the AIP is to evaluate the present condition and help predict future outcomes. By projecting the rate of deterioration, a lifecycle cost analysis can be made for various alternatives to avoid higher maintenance and repair costs in the future. Studies have shown that maintaining airport infrastructures in good condition versus periodically rehabilitating the infrastructure in poor condition reduces overall expense (Figure 1.9). Deterioration of airport infrastructures is dependent on several factors, including construction type and quality, use, climate, and maintenance (FAA Central Region, Airport's Division 2014).

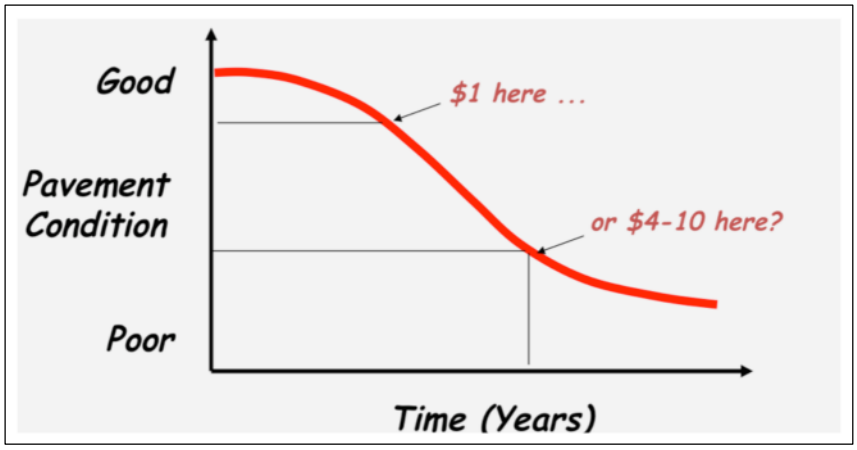


Figure 1.9 Typical payment condition lifecycle
Source: Preserving Airport Pavements, Federal Aviation Management 2011

Increased air traffic, payloads, and operations at North Dakota's airports in the oil-producing regions of the state are contributing to the increased capital costs needed to maintain and rehabilitate airport infrastructure (Figure 1.10). From 2013 to 2022, it is estimated that airports in the state will require $857.2 million for capital expenditures, including but not limited to new construction and expansion of terminals; extension, reconstruction, and rehabilitation of runways, taxiways and aprons; acquisition of land and heavy equipment; and the installation of safety and security measures including removing obstructions and installing lights for runways, taxiways, and aprons. Of the total cost, approximately, $572 million or 66.7 percent are estimated needs for commercial service airports and $285.3 million or 33.3 percent are estimated needs for general aviation airports (Figure 1.11).

Figure 1.10 Proposed airport terminal in Minot, North Dakota
Source: Minot International Airport, 2012

Figure 1.11 North Dakota Airport Capital Expenditure (estimate)
Source: Upper Great Plains Transportation Institute, 2013

1.2 Background

The impact from oil and gas extraction extends to all corners of North Dakota. The number of passengers traveling on scheduled air carriers and the use of private, business, and air charter services have increased significantly. Between 2002 and 2013, passengers boarding at the eight commercial service (CS) airports including Bismarck, Devils Lake, Dickinson, Fargo, Grand Forks, Jamestown, Minot, and Williston increased by 111.69 percent. The 2007 North Dakota State Aviation System Plan Update forecasted passenger boarding in North Dakota would exceed the one million mark in 2026. In fact, passenger boarding exceeded one million in 2012, nearly 14 years ahead of the forecast (Figure 1.12).

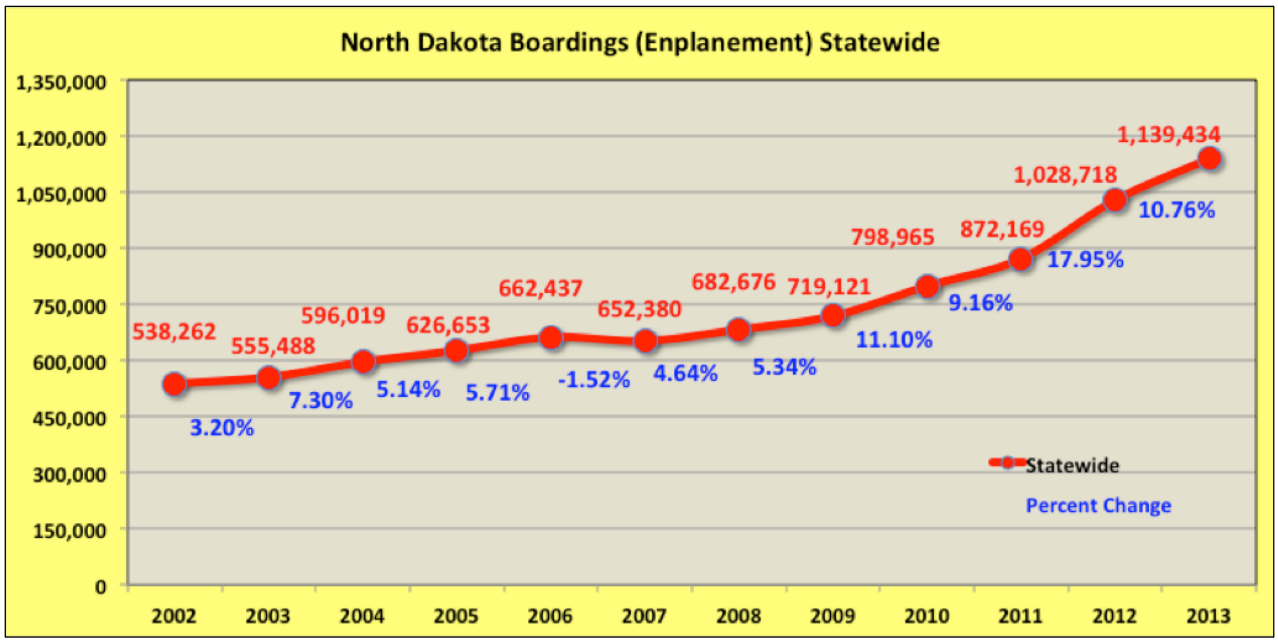


Figure 1.12 Passenger boarding at North Dakota's 8 commercial service airports
Source: North Dakota Aeronautics Commission, 2014

Much of the activity at North Dakota airports is attributed to the discovery and extraction of oil and gas in the western regions of the state. The North Dakota Department of Mineral Resources estimated that over 200 rigs and 6,839 wells were producing oil and gas in the state at the end of 2013 and forecasted that drilling activity to continue at an increasing rate to just under 60,000 wells by 2036 (Figure 1.13). Increased activity is expected to fuel rising demand for passenger and cargo air service and add pressure to the state's aviation system.

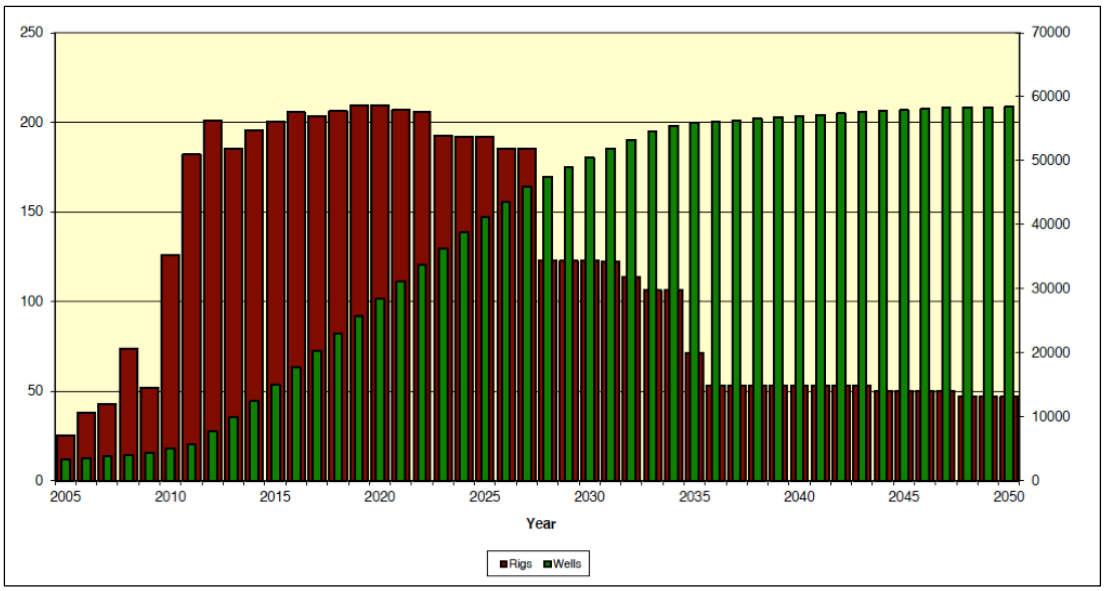


Figure 1.13 Oil and gas rigs and wells forecasted in North Dakota
Source: North Dakota Department of Mineral Resources, 2013

1.3 Purpose

The purpose of this study is to forecast the impact of oil and related economic growth on the air service (airport infrastructure) investment needs in the oil producing regions of North Dakota over the next 10 years and to offer a framework that would enable policy makers to plan for the future of aviation-related needs for the state.

1.4 Goals

The study has three goals: (a) provide information for decision makers developing policies that address the state's aviation needs, (b) guide policy makers in long-term financial planning to secure the vitality of the state's aviation systems and services, and (c) serve as an educational source for the public and industry vested in the state's aviation system on issues that impact commercial and general aviation in North Dakota.

1.5 Objective

The objective of the report is to quantify the investments necessary to meet the needs of air service infrastructure in North Dakota. This report focuses on airports owned and operated by local governments, such as cities and counties. In addition, the study will examine issues that are deemed critical to sustaining the state's air infrastructure, including:

- Assessing existing and future infrastructure and development needs of airports in the western regions of the state, including priorities and justification for airport improvement projects.
- Estimating the cost of updating and maintaining airport systems.
- Estimating the positive economic impact resulting from the growth of various market sectors, including the petroleum industry on the aviation system as well as the impact to the aviation system if oil and gas extractions decline below industry forecasts.
- Identifying key improvements to air service systems based on current and forecasted economic trends.
- Evaluating the impact of rapid population increase on commercial and general aviation markets in the state.
- Analyzing legislative policies associated with the oil and gas development and their impact on air service due to unprecedented growth in the petroleum industry.
- Presenting the study summary and related statistics to legislators seeking to develop policies to address the state's aviation needs.
- Facilitating policy advisories that assist decision makers in benchmarking future investments in the state's aviation needs.
- Informing and educating critical populations on trends, forecast, impacts, and the potential return on investment to the state's aviation systems.

2. INFRASTRUCTURE

2.1 Airports

Airports are the gateway to a community and the first structure most air travelers see when traveling to a new destination. Airports are more than a place to catch a flight, attend an in-transit business meeting, or do some shopping; they are a critical component of a community's economic development (Florida et al. 2012). Airports also provide an essential link to the nation's air space, commerce, and emergency services and are a part of the intermodal transportation infrastructure. Airports also contribute to a community's quality of life by facilitating the transport of travelers to and from abroad for recreation or to visit family and friends. North Dakota's system of 89 public airports contributes to the statewide transportation system and economy and is essential for attracting and retaining industries that rely on air transportation as a vital part of conducting business (Figure 2.1).

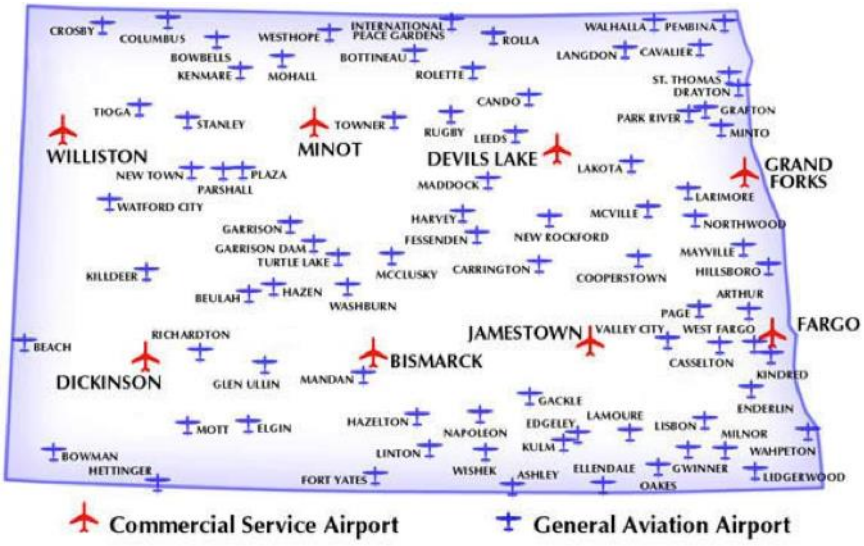


Figure 2.1 North Dakota's 89 public use airports
Source: North Dakota Aeronautics Commission (2012)

While studies show that aviation activity contributes to the economic vitality of the local economies, there is also evidence that increased activity at airports diminishes the life cycle of capital assets, including, but not limited to runways, taxiways and terminals. Degradation of airport infrastructure could reduce the margin of safety and hamper operations at airports struggling to manage passenger and aircraft traffic at levels that exceed the capacity of the facility.

2.2 Capital Needs

To insure that North Dakota's air transportation systems continue to serve the public and business interests safely and reliably, airports in the state will need substantial capital to maintain and rehabilitate infrastructure. Between 2013 and 2022, airports in the state will need an estimated $857.2 million in capital expenditures to ensure safe and reliable operations of aircraft, passengers and cargo services. The estimates are based on needs summarized by airports in the state. Approximately $594 million or 69.3 percent of the total expenditure is needed during the first five years between 2013 and 2017 and the remaining $263.2 million or 30.7 percent is needed during the second five years between 2018 and 2022.

Of the total estimated capital expenditure, $572 million or 66.7 percent is the estimated need for commercial service airports and the remaining $285.3 million or 33.3 percent is the estimated need for general aviation airports. Expenditures include, but are not limited to, new construction and expansion of terminals; reconstruction, extension and rehabilitation of runways, taxiways and aprons; acquisition of land and heavy equipment; and safety and security measures including removing obstructions and installing lighting and other equipment at runways, taxiways, and aprons.

For the purpose of illustration and to offer a basis for estimating the cost of maintaining and rehabilitating airports, North Dakota's 53 counties are aggregated into oil-producing and non-oil producing sectors (Figure 2-2). The oil-producing sector is depicted with stars (★) and located in the western or left side of the red dividing line and includes 18 counties and the non-oil producing sector is depicted with diamonds (**Δ**) and in located in the eastern or right side of the red dividing line and includes 35 counties. The sectors are sub-divided into three regions each, with the regions of Dickinson, Minot, and Williston located in the oil-producing sector and the regions of Bismarck, Fargo, and Grand Forks located in the non-oil producing sector.

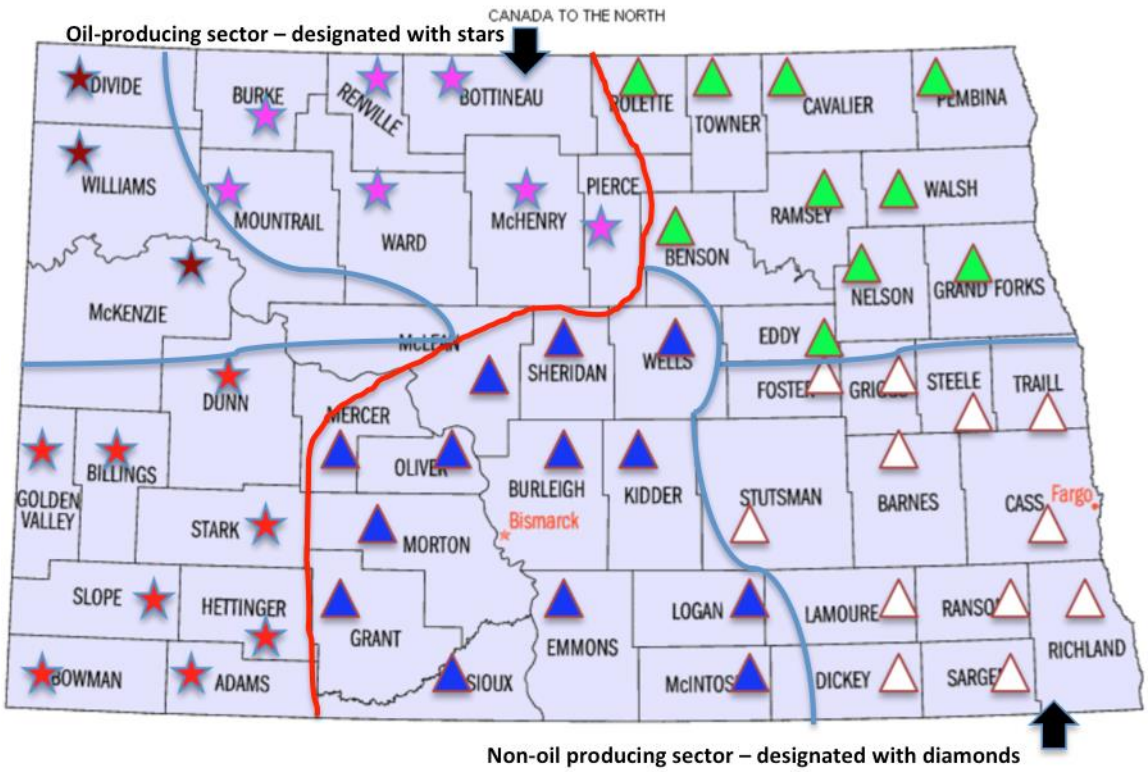


Figure 2.2 Oil-Producing and Non-Oil Producing Sectors.
Source: Upper Great Plains Transportation Institute, 2013

Within the oil-producing sector (Stars★):

- Dickinson region is depicted with **red stars** and includes the counties of Golden Valley, Billings Dunn, Slope, Stark, Hettinger, Bowman, and Adams.
- Minot region is depicted with **purple stars** and includes the counties of Burke, Renville, Bottineau, Mountrail, Ward, McHenry, and Pierce.
- Williston region is depicted with **brown stars** and includes the counties of Divide, Williams, and McKenzie.

Within the non-oil producing sector (Diamonds **Δ**):

- Bismarck region is depicted with **blue diamonds** and includes the counties of McLean, Sheridan, Wells, Mercer, Oliver, Burleigh, Kidder, Morton, Emmons, Logan, Grant, Sioux, and McIntosh.
- Fargo region is depicted with **white diamonds** and includes the counties of Forster, Griggs, Steele, Traill, Stutsman, Barnes, Cass, Lamoure, Ransom, Dickey, Sargent, and Richland.
- Grand Forks region is depicted with **green diamonds** and includes the counties of Rolette, Towner, Cavalier, Pembina, Benson, Ramsey, Walsh, Eddy, Nelson, and Grand Forks.

2.3 Oil-Producing Regions

It is estimated that airports in the oil-producing regions of Williston, Dickinson, and Minot will require $547.5 million or 63.9 percent of total capital expenditures over the next 10 years. Approximately $435.8 million or 79.6 percent of the $547.5 million is the estimated need for the three commercial service airports and the remaining $111.7 million or 22.4 percent is the estimated need for the 22 general aviation airports in these three regions.

The Williston region includes:

- Williston International Airport and three general aviation airports: Crosby, Tioga, and Watford City.
- Expenditures for this region over the next 10 years are estimated at $235.3 million or 43 percent of the total capital needs in the oil-producing sector.
- Approximately $211.2 million or 89.7 percent of the regional expenditure is for the Williston International Airport and the remaining $24.2 million or 10.3 percent is estimated for the general aviation airports.
- Expenditures in the Williston region is approximately 27.5 percent of the total capital needs over the next 10 years with nearly 94.7 percent of the expenditure needed during the first five years and the remaining 5.3 percent needed during the second.

The Dickinson region includes:

- Dickinson Regional Airport and seven general aviation airports: Beach, Medora, Killdeer, Richardton, Mott, Bowman, and Hettinger.
- Expenditures for the region over the next 10 years are estimated at $168 million or 30.7 percent of the total capital needs in the oil-producing sector.

- Approximately $122 million or 72.7 percent of the regional expenditure is for Dickinson Regional Airport and the remaining $46 million or 27.3 is estimated for general aviation airports.
- Expenditures in the Dickinson region are approximately 19.6 percent of the total capital needs for the state with nearly 66 percent of the expenditure needed during the first five years and the remaining 34 percent during the second.

The Minot region includes:

- Minot International Airport and 12 general aviation airports: Columbus, Bowbells, Mohall, Westhope, Bottineau, Stanley, New Town, Parshall, Plaza, Kenmare, Towner, and Rugby.
- Expenditures for the region over the next 10 years are estimated at $144.3 million or 26.4 percent of the total capital needs in the oil-producing sector.
- Approximately $102.6 million or 71.1 percent of the regional expenditure is for the Minot International Airport and the remaining $41.7 million or 22.9 percent is estimated for general aviation airports.
- Expenditures in the Minot region are approximately 16.8 percent of the total capital needs for the state with nearly 74.4 percent of the expenditure needed during the first five years and the remaining 25.6 percent during the second.

2.4 Non-Oil Producing Regions

It is estimated that airports in the non-oil producing regions including Bismarck, Fargo, and Grand Forks regions will require $324.1 million or 37.8 percent of the total capital expenditures over the next 10 years. Approximately $136.1 million or 42 percent is the estimated need for the five commercial service airports and the remaining $188 million is the estimated need for the 59 general aviation airports.

The Bismarck region includes:

- Bismarck Municipal Airport and 18 general aviation airports: Garrison, Turtle Lake, Washburn, McClusky, Harvey, Fessenden, Beulah, Hazen, Glen Ullin, Mandan, Hazelton, Linton, Napoleon, Gackle, Elgin, Fort Yates, Wishek, and Ashley.
- Expenditures for the region over the next 10 years are estimated at $81.7 million or 25.5 percent of the total capital needs in the non-oil producing sector.
- Approximately $34.4 million or 42.1 percent of the regional expenditure is for the Bismarck Municipal Airport and the remaining $47.3 million or 57.9 percent is estimated for general aviation airports.
- Expenditures in the Bismarck region is approximately 10 percent of the total capital needs for the state with nearly 54 percent of the expenditure needed during the first five years and the remaining 46 percent during the second.

The Fargo region includes:

- Fargo International and the Jamestown Regional Airports and 21 general aviation airports: Carrington, Cooperstown, Mayville, Hillsboro, Valley City, Page, Arthur,

Casselton, West Fargo, Kindred, Kulm, Edgeley, LaMoure, Enderlin, Lisbon, Ellendale, Oakes, Gwinner, Milnor, Lidgerwood, and Wahpeton.

- Expenditures for the region over the next 10 years are estimated at $162 million or 49.9 percent of the total capital needs in the non-oil producing sector.
- Approximately $57.5 million or 17.7 percent of the regional expenditure is for the Fargo International Airport and $9.4 million or 5.8 percent is the estimated expenditure for the Jamestown Regional Airport and the remaining $95.2 million or 58.8 percent is estimated for general aviation airports.
- Expenditures in the Fargo region are approximately 18.9 percent of the total capital needs of the state with nearly 46.5 percent of the expenditure needed during the first five years and the remaining 53.5 percent during the second.

The Grand Forks region includes:

- Grand Forks International Airport and the Devils Lake Regional Airport and 20 general aviation airports: Rolette, Rolla, Dunseith, Cando, Langdon, Walhalla, Pembina, Cavalier, Drayton, St. Thomas, Leeds, Maddock, Park River, Grafton, Minto, New Rockford, Lakota, McVille, Larimore, and Northwood.
- Expenditures for the region over the next 10 years are estimated at $80.4 million or 24.8 percent of the total capital needs in the non-oil-producing sector.
- Approximately $28.9 million or 36 percent of the regional expenditure is for the Grand Forks International Airport and $6 million or 7.5 percent is the estimated expenditure for Devils Lake Regional Airport and the remaining $45.4 million or 54.6 percent is estimated for general aviation airports.
- Expenditures in the Grand Forks region are 9.4 percent of the total capital needs of the state with nearly 55.5 percent of the expenditure needed during the first five years and the remaining 45.5 percent during the second.

2.5 Airport Funding

The Airport Improvement Program (AIP) provides grants to public agencies — and, in some cases, to private owners and entities -- for the planning and development of public-use airports that are included in the National Plan of Integrated Airport Systems (NPIAS). For small primary, reliever, and general aviation airports, the grant covers up to 90 percent of eligible costs, based on statutory requirements and the availability of funds.

AIP grants are available for planning, development, or noise compatibility projects at public-use airports, including heliports and seaplane bases. A public-use airport is an airport that is publicly or privately owned, but designated by the FAA as a reliever airport or privately owned but having scheduled service with at least 2,500 annual enplanements. To be eligible for a grant, an airport must be included in the NPIAS. The NPIAS is published every two years and identifies public-use airports that are considered essential to public transportation and supports the needs of civil aviation, national defense, and the postal service (Federal Aviation Administration 2014).

Recipients of grants are referred to as "sponsors" and must be legally and financially responsible to carry out the obligations contained in the grant agreement. The description of the eligible grant is described in the authorizing legislation and relates to capital expenditures designed to improve the airport in areas of safety, capacity, and noise compatibility. Professional services such as planning, surveying, and design work are also eligible for funding; however, projects must meet federal environmental and procurement requirements. Costs associated with airport projects intended to generate revenue or operate the airport such as salaries, equipment, and supplies are not eligible for AIP grants (Federal Aviation Administration 2014).

3. ECONOMIC IMPACT / TRENDS AND FORECASTS

Microsoft's founder Bill Gates observed, "The Wright Brothers created one of the greatest culture forces since the development of writing, for their invention effectively became the World Wide Web of that era, bringing people, languages, ideas and values together." It also ushered in an age of globalization, as the world's flight paths became the superhighways of an emerging international economy (Airlines for America.org, 2013).

Demand for air service increases the influence of air transport on the global economy, making possible the rapid movement of millions of people and billions of dollars worth of goods around the world. The industry plays a decisive role in the work and leisure of millions of people. It promotes an improved quality of life and helps to improve living standards. By facilitating tourism, air transport also helps generate economic growth and alleviate poverty, providing employment opportunities, and increasing revenues from taxes (Air Transportation Action Group, 2004).

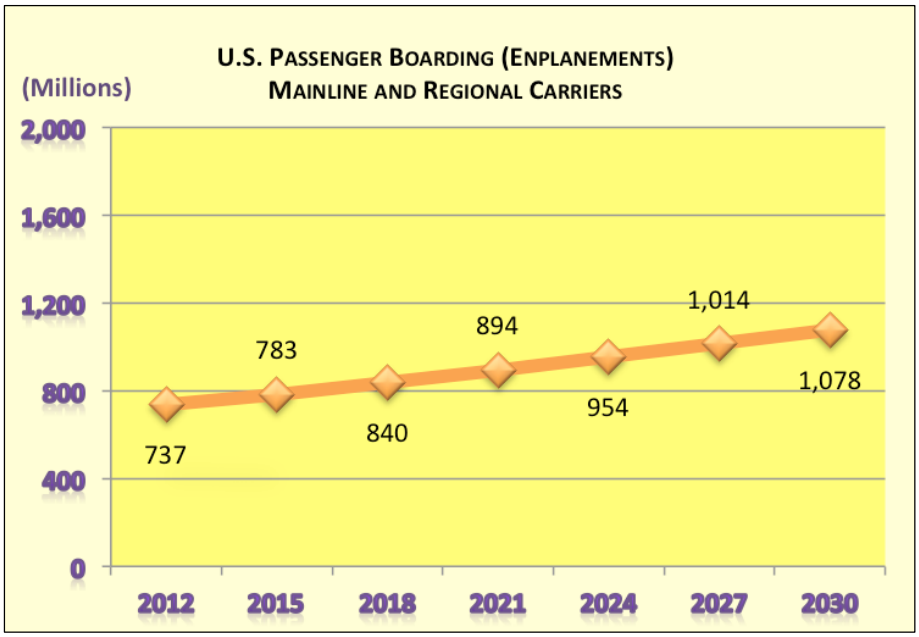
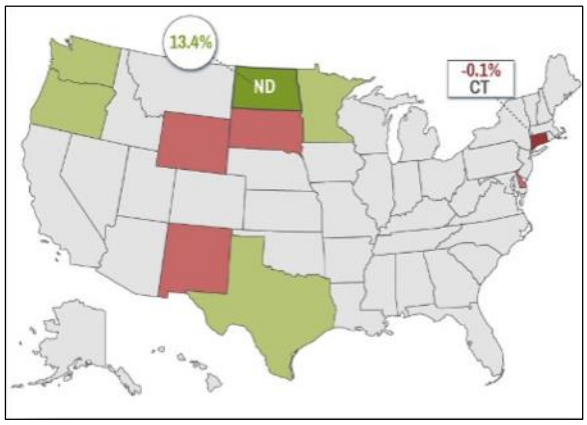


Figure 3.1 U.S. enplanement forecast
Source: FAA Aerospace Forecast, 2013

3.1 Air Service

The Federal Aviation Administration (FAA) estimates there were a total of 737 million enplanements in the United States in 2012, an increase of 0.8 percent over 2011. Nearly 575 million or 78 percent of the enplanements were aboard mainline air carriers and the remaining 162 million traveled aboard regional carriers. Enplanements are forecast to increase to 1 billion by 2030 (Figure 3.1), an increase of 46.4 percent (FAA Aerospace Forecast, 2013). The FAA also estimates that general aviation and air taxi aircraft in the United States logged over 6 million hours in 2012, an increase of 3.6 percent over 2011 and forecasts the industry to log nearly 12 million miles by 2030, an increase of nearly 89 percent. In addition, U.S. manufacturers of general aviation aircraft reported delivering 1,514 aircraft in 2012, a 3.3 percent increase over the previous year, translating into the second year of increase in shipments (FAA Aerospace Forecasts, 2013).

Propelled by the discovery of oil and gas in the western regions of North Dakota, the state's economy has a growth rate five times the national average, posting a $38.7 billion or 13.4 percent growth in 2012. The growth rate is nearly three times as fast as Texas, the state with the second highest U.S. growth rate at 4.8 percent. North Dakota growth also exceeds the national average growth rate of 2.5 percent. The Bureau of Economic Analysis (BEA) estimates that North Dakota will experience its third consecutive year of growth (Figure 3.2), higher than any other state in the U.S. (Hargreaves, 2013).



2012 Economic Growth

North Dakota	13.4%
Texas	04.8%
Oregon	03.9%
Washington	03.6%
Minnesota	03.5%

Figure 3.2 2012 Economic growth rate of the top 5 states in the U.S.
Source: CNN.Money.com

Researchers studying the rate of employment growth associated with the extraction and production of the oil and gas in the Bakken region of North Dakota estimate that employment in the state will peak in the next 6 to 12 years, depending on the rate of future oil field development. Shifts in employment within the oil and gas industry occur primarily due to growth in gathering systems, drilling and fracking operations, and oil field services (Bangsund and Hodur, 2013). Not accounting for employment associated with the development of direct and indirect ancillary industries associated with the petroleum industries such as housing, transportation, education, government, and retail, employment is expected to decline after reaching its peak as the number of oil rigs decline and labor efficiencies improve. Once labor associated with construction of the oil field gathering systems is removed; employment in the industry is largely driven by oil field service and well development (Bangsund and Hodur, 2013).

Activity related to the production of oil and gas has contributed to the increased demand for air service in the western region of North Dakota, along with spillover effects in the central and eastern areas of the state. Communities such as Dickinson, Minot, and Williston are experiencing unprecedented population growth and demand in air traffic. In just over a decade, population in these three communities grew from 65,476 in 2000 to 81,975 in 2012, a 25.2 percent increase (Citypopulation.de, 2013). Similarly, enplanements at the commercial service airports in the oil-producing sector of North Dakota grew from 77,645 in 2000 to 283,519 in 2012, an increase of 265 percent or an average annual increase of 22 percent. It is unprecedented for communities with a population less than 100,000 to experience such rapid increases in enplanements. In fact, enplanements exceeded forecasts by nearly 187 percent over the same period, (North Dakota State Aviation System Plan Update, 2007).

3.2 Impact of Discovering Oil and Gas

Approximately a decade ago, the petroleum industry began investing in the exploration of oil and gas deposits in western North Dakota using technology that had not been available to the industry during previous exploration in the 1950s and 1980s. This time, the industry's prediction suggested that large deposits of oil and gas were extractable from deep underground rock formations. Such predictions had been dismissed as purely hypothetical. This dismissal was understandable, given the state's previous experience decades ago when similar optimistic predictions did not materialize.

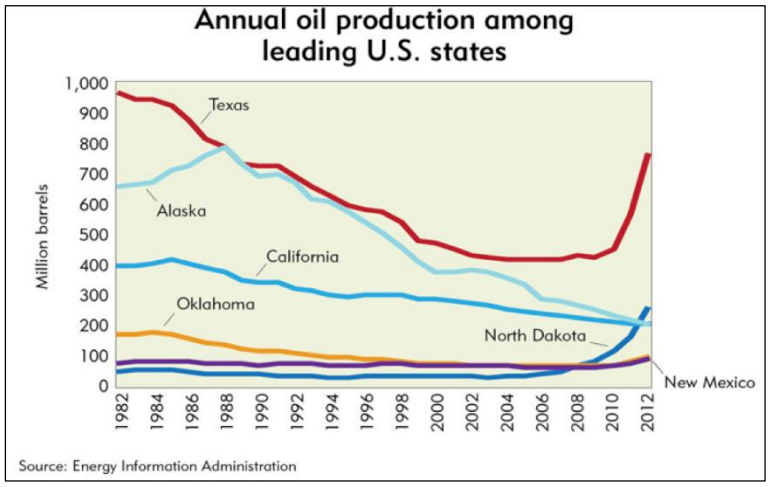


Figure 3.3 Annual oil production among leading U.S. States
Source: Energy Information Administration, 2012

The past was no guide to predicting North Dakota's role in extracting and producing oil and gas from shale formations. Fracturing technology helped the state surge past Oklahoma, Louisiana, California, New Mexico, and Alaska to become the country's second-largest oil producer, after Texas (Figure 3.3). The past was also no guide to policy makers in facilitating plans for the state's unprecedented economic growth that has impacted virtually all economic indices, including, but not limited to housing, law enforcement, government, retail, employment, and transportation.

Discovery of oil and gas in the Bakken has increased the demand for labor. Workers from around the county have converged on North Dakota to work in the petroleum industry, resulting in a shortage of housing. In 2013, the North Dakota Department of Mineral Resources reported that the petroleum sector employed over 10,000 workers in state in 2007. The Department is projecting that petroleum related employment would peak to nearly 70,000 by 2028 (Figure 3.4).

In addition, there are shortages of construction labor, supplies, and vendors to build homes and apartments. Some builders are shipping in lumber from as far away as Arizona (Wong, 2013). An increase in population has also increased the crime rate, taxing local law enforcement agencies. Criminal incidents reported at the Williston Police Department have increased significantly. The department received 1,000 calls in one summer compared to 4,000 calls in the previous three years combined (Ellis, 2011). The shortage of workers is particularly acute in the service industry, such as health care, childcare, and the food service industry. Restaurants often have to close early due to a shortage of labor and it is not uncommon to wait for an hour or more to be served in a crowded restaurant (Wong, 2013). The cost of living has also skyrocketed along with the increase in wages among various sectors that are directly and indirectly related to the oil

and gas industries. Average wages among communities in the oil patch have risen from $32,000 in 2006 to $80,000 in 2012 (MacPherson, 2012).

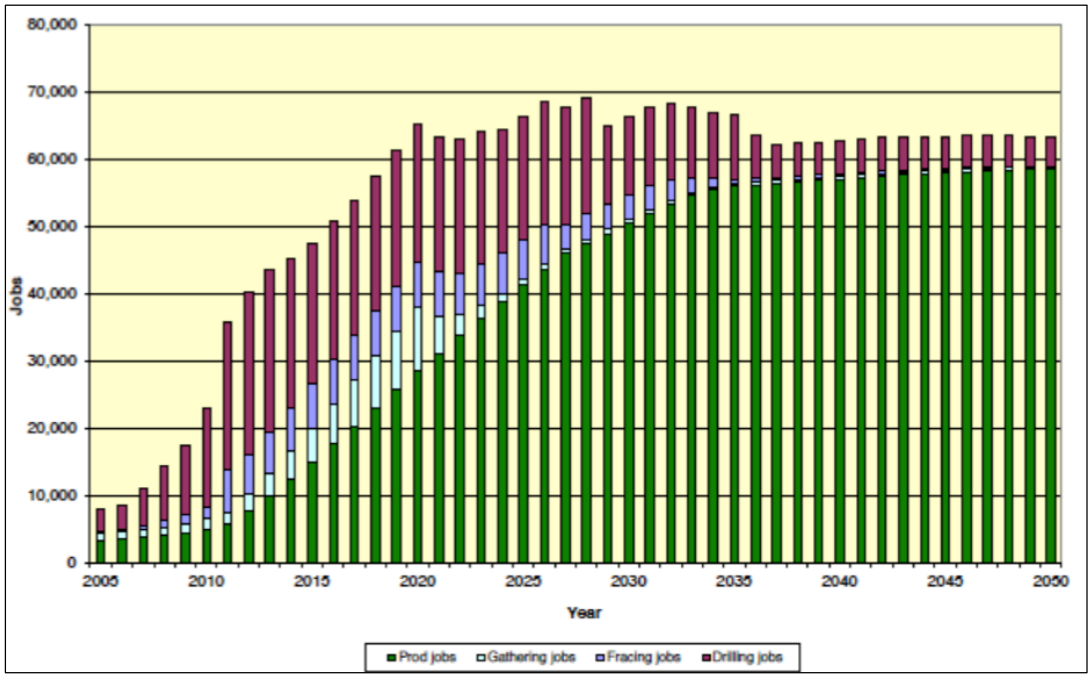


Figure 3.4 North Dakota employment forecasts in the petroleum industry (2000–2050)
Source: North Dakota Department of Mineral Resources, 2013

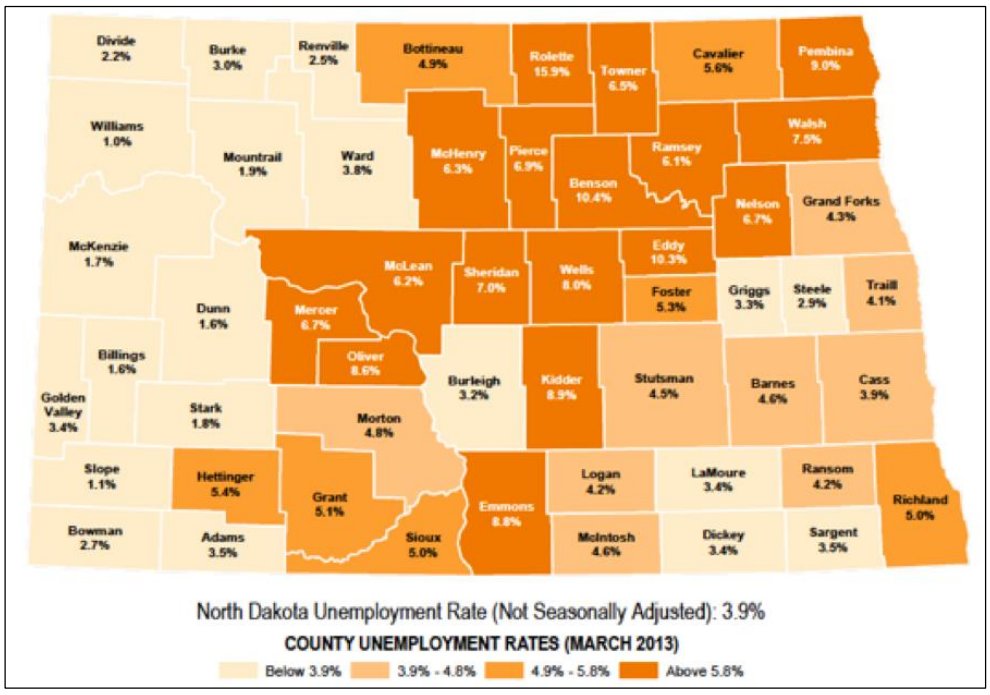


Figure 3.5 North Dakota unemployment rate by county as of March 2013
Source: Labor Market Information Center, 2013

Rising income has also had positive affects in these communities. Those employed in the petroleum industry earned on average $94,484 in 2012. Higher income is allowing households that traditionally relied on two incomes to support a family to do so with one, giving the other family member the option to opt out of the job market

(Kilmasinska, 2013). In addition to higher wages, those looking for a job can find one. North Dakota reported an unemployment rate of 3.3 percent in February 2013, the lowest in the nation (Figure 3.5), compared with 7.6 percent unemployment nationally (Kilmasinska, 2013).

Economic activity from oil and gas production provides substantial government revenues through tax collection, royalty revenue, lease bonuses, and severance taxes. In addition to public sector revenues, the petroleum industry acts as a solidifying force in the state's economy through an expansion of industry-based employment and indirectly through secondary economic activity. It is estimated that the combination of in-state expenses for exploration and lease bonuses, as well as secondary economic impacts associated with exploration and development, contributed to the in-state gross business volume of $16.8 billion in 2011. However when capital expenditures for infrastructure projects are added to the other segments of the industry, the gross business volume in 2011 is estimated at $30.4 billion (Bangsund and Hodur, 2013).

While there has been considerable information in the media and in published reports on the economic impact in North Dakota resulting from oil and gas development activities, there has been far less on the impact of such discoveries on the state's infrastructure. This is particularly true of the impact on the state's aviation systems, including, but not limited to airport, runways, taxiways, and terminals in cities like Dickinson, Minot, and Williston that are located in the heart of the state's oil patch.

3.3 Dickinson

Dickinson is one of three major cities in the Williston Basin impacted by the oil and gas discovery in the Bakken and Three Forks formations. In 2000, the city's population was just over 16,000. By 2010, the population had grown to 17,787, a gain of 11 percent. Dickenson's Theodore Roosevelt Regional Airport serves the city and its surrounding communities (Figure 3.6). Over the last three years (2011-2013), enplanements at the airport increased by 85 percent, and increased in total by 1107 percent over the last twelve years between 2002 and 2013. Based on historical data, enplanements had been forecast to hold between 5,000 and 5,400 (Figure 3.7).

Figure 3.6 Dickinson TR Regional Airport
Source: U.S. Geological Survey, 2012

The city's 2012 comprehensive plan estimates that Dickenson will grow at a rapid pace for several years, with the potential of doubling its population within the next decade to more than 40,000 by 2035 (Kadrmas, Lee, and Jackson, 2012). Consultants studying the city's capital needs, estimate that Dickenson will need to spend over $817 million in capital improvements over the next 22 years (2013 to 2035), an average of $37 million per year.

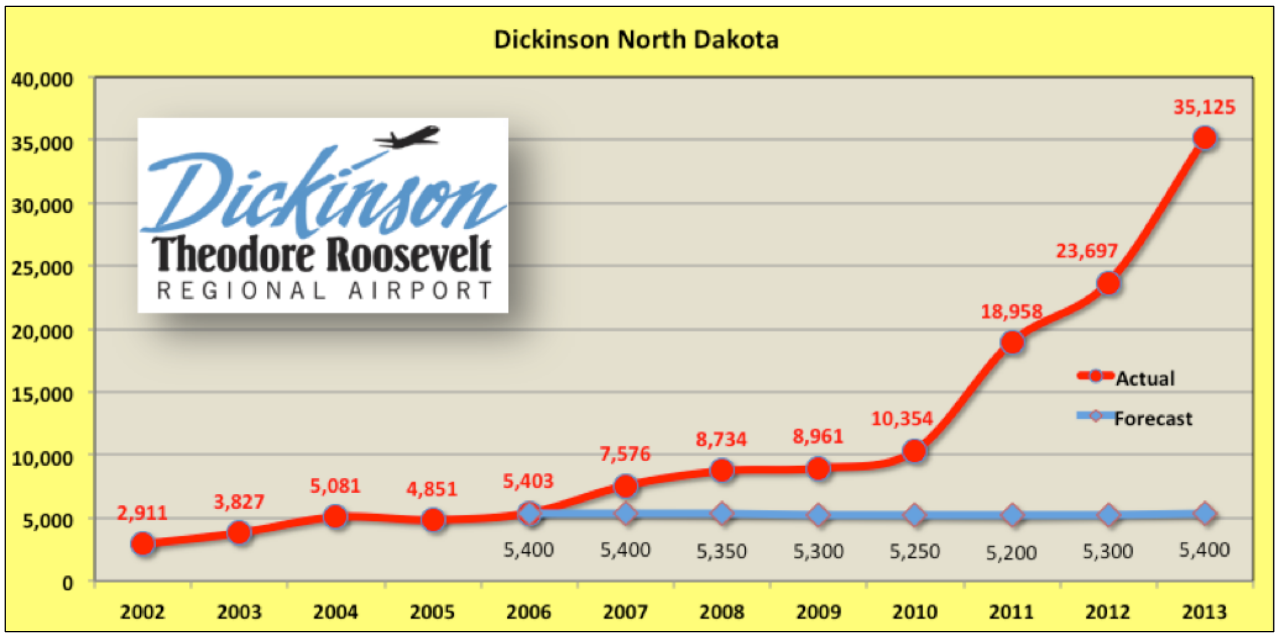


Figure 3.7 Dickinson Regional Airport enplanement, (2002–2013) actual and (2006–2013) forecast
Source: North Dakota Aeronautics Commission, 2012 & Kadrmas, Lee, and Jackson, 2007

3.4 Minot

North Dakota's fourth largest city, Minot is located in Ward County in north-central North Dakota. Located in the center of the oil field development, the city boasts one of the nation's lowest unemployment rates. By the end of 2011, Minot's unemployment rate stood at 3.1 percent compared to 8.3 percent, nationally. The city is host to the Minot Air Force Base that includes over 7,000 personnel. Minot's population grew by 18.6 percent between 2000 and 2012. Consultants working on the city's comprehensive plan project population growth by an additional 14,000 over the next 20 years (Bonestroo Consulting, 2011).

Figure 3.8 Minot International Airport
Source: U.S. Geological Survey, 2012

The Minot International Airport is a non-hub, primary airport located two miles north of the city (Figure 3.8). The airport is owned and operated by the city and includes several major air carriers that connect travelers from Minot and surrounding communities to Minneapolis, Denver, Las Vegas, Phoenix, and other destinations. Over the last three years (2011-2013), enplanements at the airport increased by 48 percent, and increased in total by 215 percent over the last twelve years between 2002 and 2013. The 2013 enplanements accounted for nearly one-fifth (19.5 percent) of all enplanements at North Dakota's eight commercial service airports. Based on historical data, enplanements had been forecast to hold between 75,000 and 87,000 (Figure 3.9).

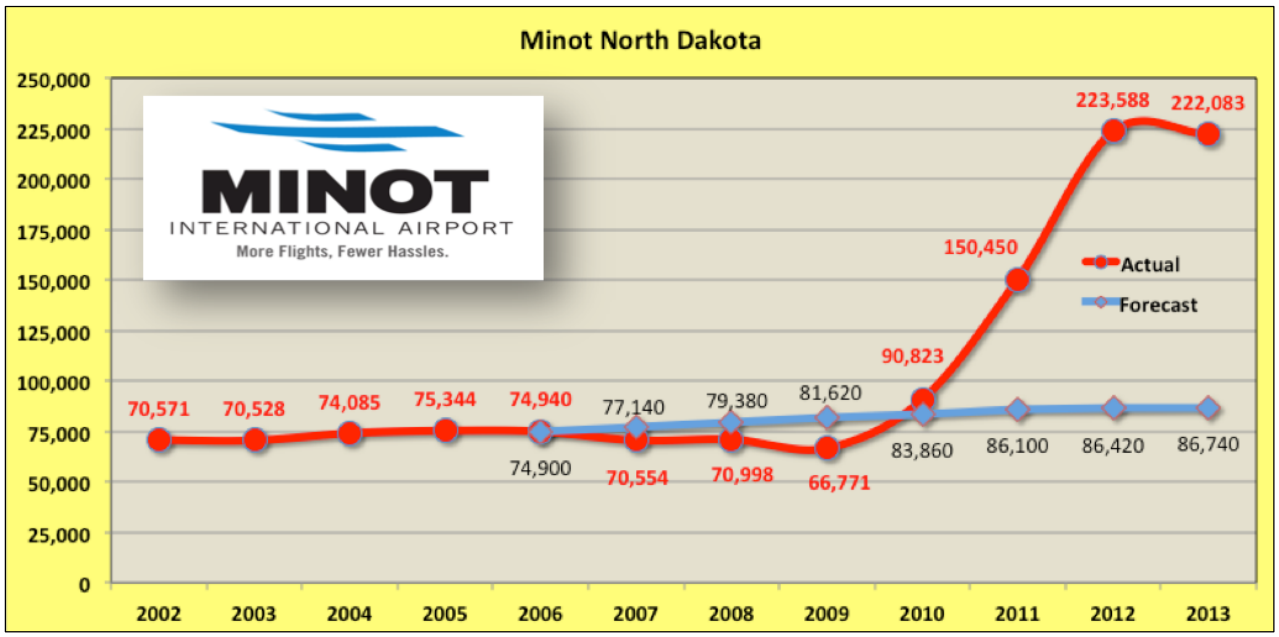


Figure 3.9 Minot International Airport enplanement, (2002–2013) actual and (2006–2013) forecast
Source: North Dakota Aeronautics Commission, 2012 & Kadrmas, Lee, and Jackson, 2007

3.5 Williston

Located in the heart of the Bakken and Three Forks region, the city of Williston has experienced the largest gain in population of cities in the oil patch, growing by 47.7 percent between 2000 and 2012. The discovery of oil and gas has boosted the annual average wage in Williston by 119 percent from $31,956 in 2006 to nearly $71,000 in 2011 (Koeser, 2011). Increasing wages and demand for workers in the petroleum sector has provided Williston with the lowest unemployment rate in the state at less than 1 percent. Higher wages also makes the city the largest collector of sales tax revenue among the state's eight largest cities.

Figure 3-10. Williston International Airport
Source: U.S. Geological Survey, 2012

Williston is projected to spend $544 million on capital expenditures that include expanding government facilities, water management, surface transportation, and relocating or expanding its airport at an estimated cost of $150 million (Koeser, 2011). In just over a decade, enplanements at the Williston Sloulin International Airport (Figure 3.10) grew from 4,163 in 2002 to 94,459 in 2013, an increase of over 2169 percent. Over the last three years (2011-2013), enplanements at

the airport increased by 240 percent. Based on historical data, enplanements had been forecast to hold between 5,600 and 7,200 (Figure 3.11).

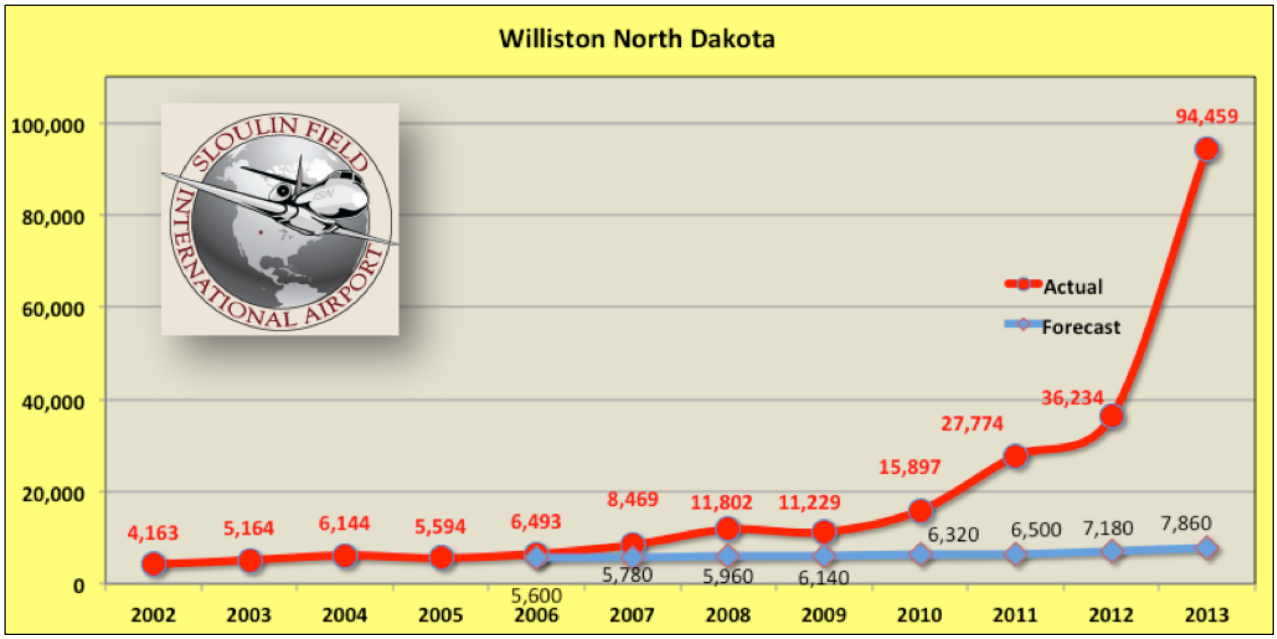


Figure 3.11 Williston International Airport enplanement, (2002–2013) actual and (2006–2013) forecast
Source: North Dakota Aeronautics Commission, 2012 & Kadrmas, Lee, & Jackson, 2007

Growth is not without its challenges. Williston is home to over 350 oil and gas related businesses. Trucks supporting oil and gas production activities make an average 2,000 truck trips per oil well transporting sand, water, oilrig equipment, chemicals, and fuel. Heavy truck traffic damages road infrastructure, requiring maintenance of roads, bridges, and other access ways. The city is planning to spend an estimated $140 million in short-term and over $118 million in long-term surface infrastructure improvements (Koeser, 2011). In addition, the city has experienced a shortage of housing, increased traffic, and demand for public services, including but not limited to school, law enforcement, and water management.

3.6 Trends in Non-Oil Producing Regions

Extraction and production activity, delivery of goods and services to the petroleum industry, and national and international business interests in oil and gas development have spurred air travel in many parts of North Dakota, including communities where the petroleum industry has yet to drill wells. Airports in the non-oil producing regions of central and eastern North Dakota, including Fargo, Bismarck, and Grand Forks have experienced a significant increase in enplanement.

Between 2002 and 2013, enplanement at the Fargo International Airport, Bismarck Municipal Airport, and Grand Forks International Airport, increased by 73 percent, 71 percent, and 69 percent respectively (Figure 3.12). Enplanement increases of between 55 and 70 percent over a 10-year period are unprecedented in the aviation industry.

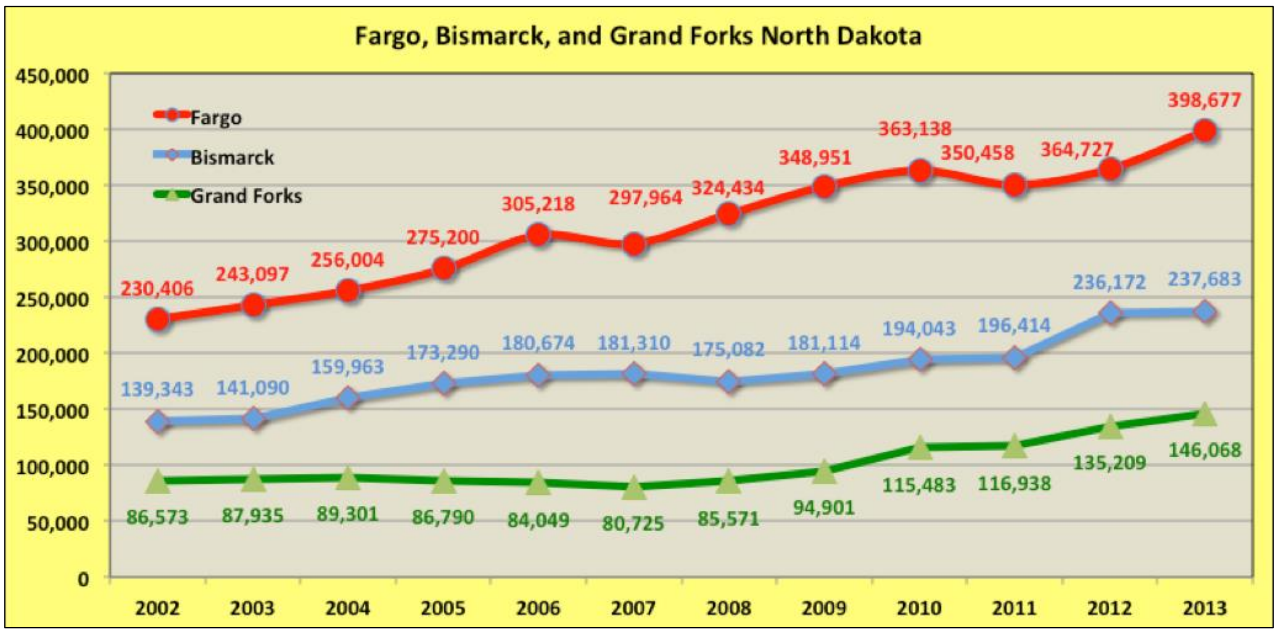


Figure 3.12 Bismarck, Fargo, and Grand Forks enplanements (2002–2013)
Source: North Dakota Aeronautics Commission, 2012

Between 2011 and 2012, North Dakota had the largest increase (25.2 percent) in capacity *(measured in terms of available seats aboard scheduled air carriers)* among states in the central region of the United States including Iowa, Minnesota, and South Dakota with increases of 8, 4.2, and 0.3 percent respectively. North Dakota also took the top spot when compared nationally to states with the 10 highest changes in weekly seat capacity when comparing the November 2011 figures with November 2012. North Dakota increased by 25.2 percent, five times that of Oregon, New York, Minnesota, Colorado, and Florida; three times that of Iowa and Montana; and nearly twice that of Hawaii, the state with the second highest change (Figure 3.13). Among the states compared in 2012, North Dakota had the smallest population of 700,000 and New York had the largest of 19.5 million (Icfi/SH&E, 2012).

Between December 2011 and November 2012, Minot, Grand Forks, Fargo, and Bismarck had the highest seat capacity of the eight commercial service airports in North Dakota, ranging between 5,000 and 25,000 seats. Jamestown, Devils Lake, and Dickinson had seat capacity ranging from 700 to 4,200 seats during the same period (Icfi/SH&E, 2012).

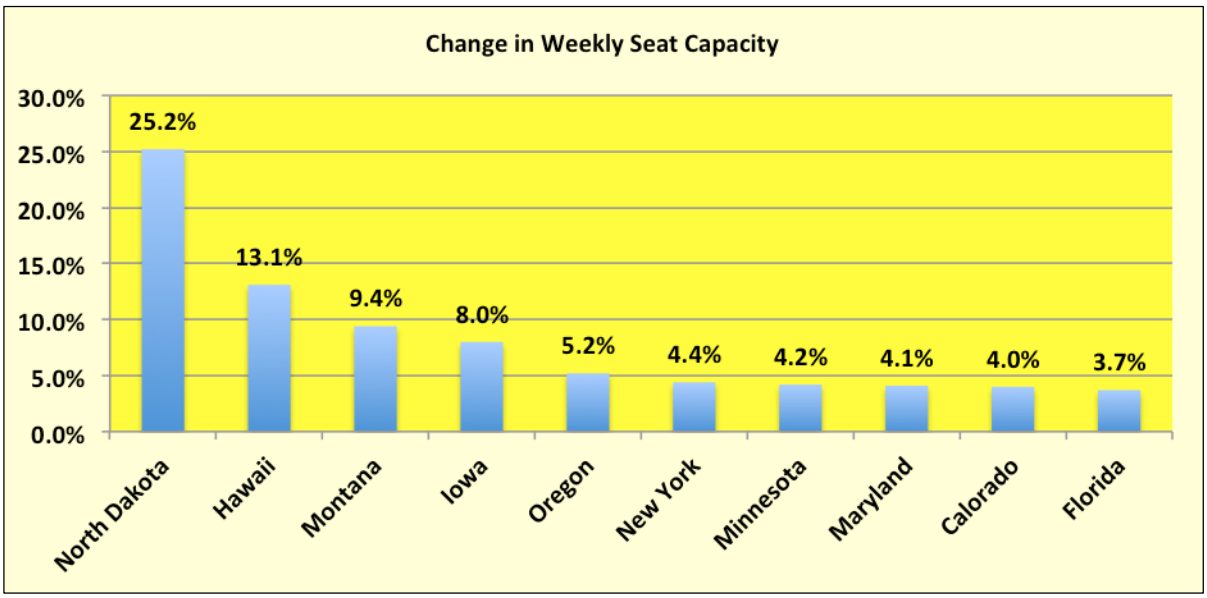


Figure 3.13 Change in weekly seat capacity (November 2011 vs. November 2012)
Source: ICF / SH&E, 2012

3.7 Derived Demand

The number of available seats on an air carrier on a given day at a specific departure point is directly related to derived demand. In economic systems, what takes place in one sector impacts another; demand for goods or services in one sector is derived from another. A consumer purchasing goods in a store will likely trigger the replacement of that product, which generates demands for activities such as manufacturing and resource extraction. However, transportation cannot exist alone and the movement of passengers and airfreight cannot be stored.

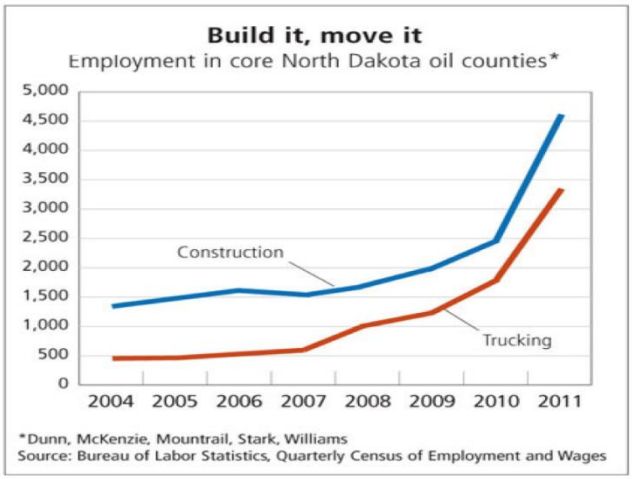


Figure 3.14 Employment in core North Dakota counties
Source: Bureau of Labor Statistics

A product can remain on the shelf until it is sold. However, an unsold seat or unused cargo capacity on an air carrier cannot be brought back as additional capacity. In this case an opportunity has been missed since the amount of transport offered (seat and freight capacity) exceeds demand (Rodrigue and Notteboom, 2013). Air carriers serving the Bakken, Three Forks, and Eagle Ford regions in North Dakota and Texas adjust their available seat capacity based on demand that is driven, at least in part, by oil and gas production activity and includes the transportation of freight and workers directly employed in the petroleum industry. These workers include those who operate drilling rigs, gas processing plants, and refineries. Demand is also impacted by non-direct or secondary

employment that is created as a result of the business activity generated by the petroleum industry, but is not directly part of the industry, including, but not limited to: housing, retail, education, and government services (Bangsund and Hodur, 2013).

Researchers at North Dakota State University studying employment created by the petroleum industry in the Williston Basin developed various estimates of direct and secondary jobs created as a result of oil and gas production activity. One estimate was based on data collected by surveying oil operators, service and support firms, and processors. A second estimate was based on data from the Job Service of North Dakota. A third estimate was generated from data obtained from North Dakota Workforce Safety and Insurance. A final estimate was provided using a model developed by the researchers that uses employment coefficients from the Oil and Gas Division of the North Dakota Department of Mineral Resources.

Jobs associated with oil and gas extraction, included, but are not limited to: construction, manufacturing, wholesale trade, transportation, refining, drilling, well suppliers, geologists, professional and business representatives, clerical, and support functions (Figure 3.14). Estimates ranged from a low of 6,100 to a high of 12,400 in 2003 and a low of 32,700 to a high of 39,600 in 2011. Secondary employment supported by the petroleum industry was estimated at 18,700 in 2011 (Bangsund and Hodur, 2013).

3.8 Forecasts – Oil and Gas Industry

Researchers forecasting future direct employment in the industry developed three estimates including low, consensus, and high. The low estimate is based on the premise that economic conditions in the future would be worse than current conditions; the consensus estimate is based on the premise that economic conditions remain relatively similar to years earlier than 2012; and a high estimate is based on the premise that economic conditions would improve relative to years earlier than 2012 (Bangsund and Hodur 2013).

Direct employment in the industry is estimated at a low of 39,000, at a consensus of 41,000, and a high of 42,000 in 2013. It is projected that jobs in the industry will peek at a low estimate of 45,000 in 2019, a consensus estimate of 53,000 in 2021, and a high estimate of 60,000 in 2022. Overall labor in the petroleum sector is projected to decline between 2019 and 2036 to a low estimate of 31,000, a consensus estimate of 38,000 and a high estimate of 42,500 (Figure 3.15). Declining rig counts and reduced labor requirements associated with efficiencies in future drilling operations reduce labor in that segment of the industry while labor in the oil service segment of the industry increases. Labor efficiencies associated with oil field service offset some of the employment gains associated with an increase in well counts. This trend contributes to the slow decline in overall employment (Bangsund and Hodur, 2013).

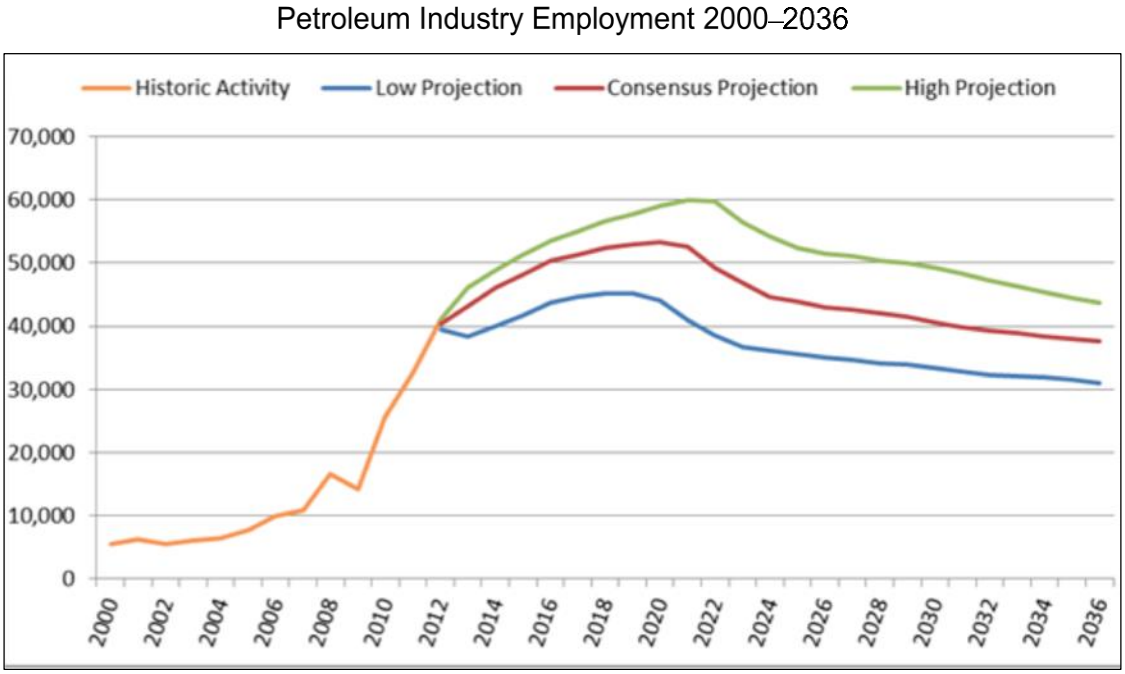


Figure 3.15 Direct employment – petroleum industry – historical, low, consensus, and high projection
Source: Bangsund and Hodur, 2013

Forecasting an outcome into the future is at best an educated estimate. There is no way to guarantee an outcome without also guaranteeing that all the variables that could affect the outcome into the future would remain constant. There is also no way to guarantee that the variable, even if held constant, would affect the process in the same manner. For example, we can quantify direct derived demand, such as work-related activity which involves commuting between the place of residence and the workplace because it is the outcome of movement that is directly the outcome of economic activity. There is a supply of work in one location (residence) and a demand of labor in another (Bakken and Three Forks shales), transportation (commuting by air, rail, and road) being directly derived from this relationship. Thus, transportation is the direct outcome of the functions of production and consumption. On the other hand, indirect derived demand is the movement created by the requirements of other movements, such as fuel consumed by air carriers that must be supplied by an energy production system requiring movement from areas of extraction to refineries to storage and finally to places of consumption (Rodrigue and Notteboom, 2013).

3.9 Forecasts – Aviation Industry

The number of available seats at a departure point, the number and frequency of flights to and from a location, and the number of enplanements is directly related to the demand for air service. Empirical evidence suggests that significant increases in demand for air service in North Dakota started as oil and gas production activities began to take shape in the western regions of the state.

Policymakers have had limited opportunity to develop long-term sustainable plans necessary to manage expectations and to properly allocate sufficient resources to address long-term development due to the speed and magnitude of the petroleum activity growth in the oil patch regions. In addition, policy makers have had limited information about how to manage the current economic boom relative to previous oil booms that produced limited activity relative to the present. For example, wells drilled in the oil patch increased from 5,000 in 2005 to 7,000 in 2012, an increase of 40 percent. Over the next seven years, researchers are forecasting the number of wells drilled to increase by 186 percent on the low projection to 20,000, to a mid-range (consensus) projection of 22,000, to a high projection of 23,000 by 2019. Over the following seven years, researches are forecasting on a low projection that 27,000 wells would be drilled, to a consensus projection of 33,000, and a high projection of 37,000 wells by 2026 (Bangsnd and Hodur, 2013).
Over the course of the previous 11 years 7,731,718 passengers enplaned at North Dakota's eight commercial service airports or an average of 702,883 enplanements per year. Enplanements accounted for 16.3 percent per year when averaged over three years (2010, 2011, 2012). Enplanement drops to 11.8 percent per year when averaged over the previous 5 years, and drops to 9 percent per year averaged over 7 years.

Enplanement increases forecasted for the next 10 years is based on the average increase in the rate of enplanement over the past 3 years and the estimated number of oil wells forecasted to be in operation over the same period (Figure 3.16). These estimates, include a low projection, which is based on the premise that economic conditions would be worse than current conditions, a mid-range projection, which is based on the premise that economic conditions would be similar to current conditions, and a high range, which is based on the premise that economic conditions would be better than current conditions.

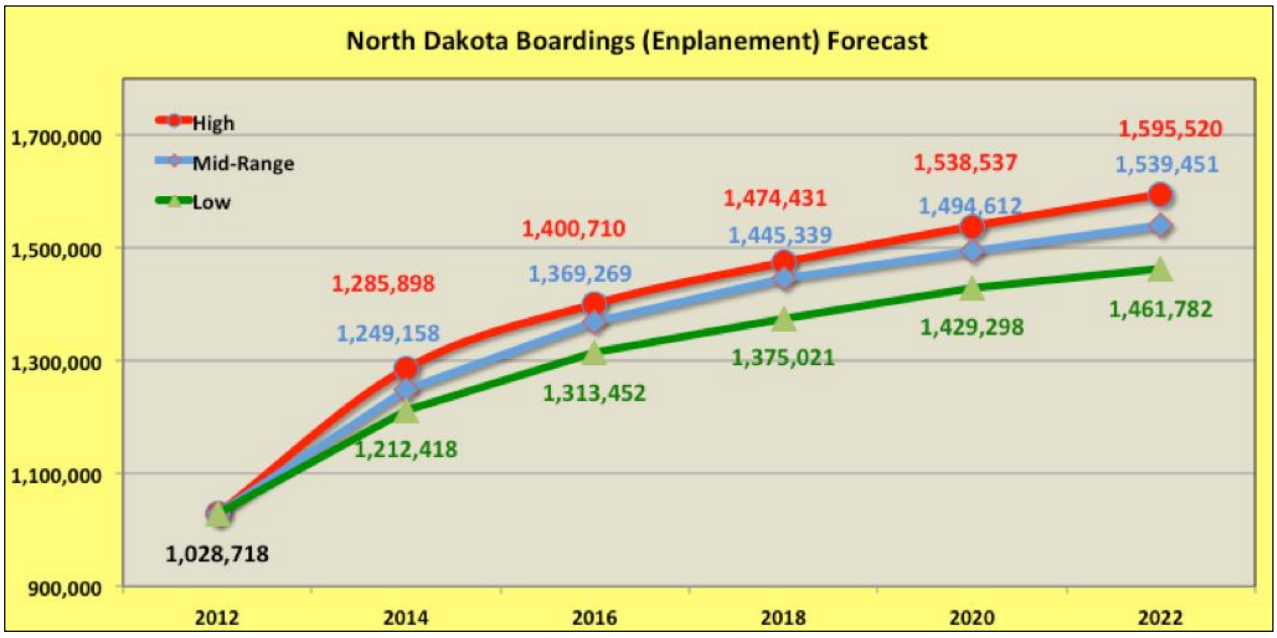


Figure 3.16 Enplanement forecast for North Dakota (2012 – 2022)
Source: Upper Great Plains Transportation Institute

In 2005, airlines provided service between North Dakota and approximately six cities in the United States, versus, 2014, when air service doubled providing service between North Dakota and 12 cities across the nation (Figure 3.17).

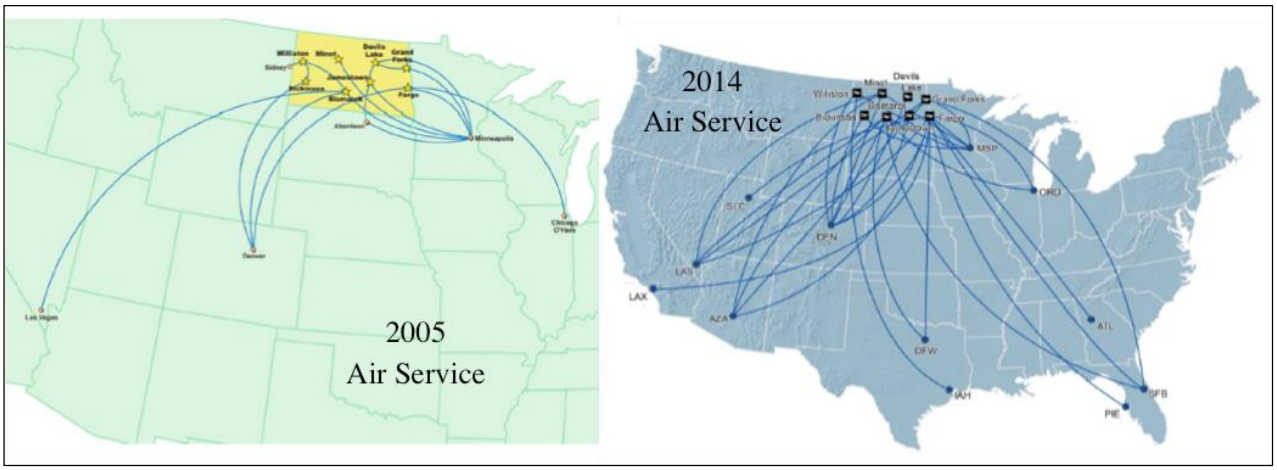


Figure 3.17 Air service between North Dakota and cities in the USA in 2005 and 2014
Source: North Dakota Aeronautics Commission, 2014

Based on the above, enplanement between 2012 and 2014 are forecast to:

- Increase by 17.9 percent from 1,028,718 to 1,212,418 on the low projection
- Increase by 21.4 percent to 1,249,158 on the mid-range projection
- Increase by 25.0 percent to 1,258,898 on the high projection

In 2013, North Dakota enplanement of 1,139,434 was an increase of 10.76 percent over the previous year (one year change). By the end of 2014, enplanement is expected was fall within the low to mid-range forecast for the two-year period (2012–2014).

Between 2014 and 2022, enplanements are forecast to:

- Increase by 20.6 percent to 1,461,782 on the low projection
- Increase by 23.2 percent to 1,539,451on the mid-range projection
- Increase by 24.1 percent to 1,595,520 on the high projection

Forecasts cannot account for every variable that could impact an outcome. A number of "chaotic" variables could potentially increase or decrease projections, including, but not limited to: the number of oil wells in operation, available seat capacity, demand and availability of labor in the petroleum industry, secondary industries that might grow as a result of the growth of the oil and gas industry, government policies, technological advances for exploring and extracting natural resources, and world demand for crude oil and natural gas.

4. LEGISLATION AND AVIATION

Airports face a variety of operational and safety concerns when funding for airport maintenance and rehabilitation falls below the level needed to efficiently operate the facility within prescribed boundaries set by the Federal Aviation Administration (FAA) and local authorities. Airside development projects are deemed critical for the safe operation of airports and historically the FAA has awarded approximately 65 percent of the Airport Improvement Program (AIP) grants for runways, taxiways, aprons, navigation aids, lighting, and air safety projects. The remaining funds go for state block grants and noise abatement programs. Less than three percent of AIP funds are spent on roads located on airport property (Kirk, 2007).

Highlighting the need for airport funding, the Airport Council International-North America (ACI-NA) identifies that U.S. airports currently have a need in excess of $80 billion worth of capital projects. The FAA puts the figure at a $52 billion. However, congressional allocation for AIP funding is approximately $3.5 billion per year. This places U.S. airports and aviation infrastructure needs far behind other nations. In fact, the World Economic Forum ranks U.S. aviation infrastructure 32nd in the world, behind countries such as Panama, Chile, and Malaysia (Center for Aviation, 2011).

4.1 Legislative Assembly

The 63rd North Dakota Legislative Assembly convened in regular session on January 8, 2013, and concluded on May 4, 2013. During the legislative assembly, the House and Senate chambers voted on 842 bills and 74 concurrent resolutions. Governor Jack Dalrymple signed over 500 bills into law (North Dakota State Government, 2013). Included in the legislation were bills proposed by the Governor, and House, and Senate members in support of aviation in North Dakota, including bills that would invest capital for infrastructure projects in the oil producing sector of the state; provide grants for commercial service (CS) and general aviation (GA) airports; and appropriate monies from the general fund for public airports in need of financial assistance.

The method by which bills are introduced in the North Dakota legislature, assigned to committees, debated, voted by both houses, and signed into law by the Governor, follow a long established process that is both traditional and deliberate in nature. Several House and Senate members introduced bills in support of aviation during the legislative assembly. The bills were assigned a number for the purpose of tracking them as they made their way through various House and Senate committees. The committee chairs scheduled hearings on the bills, whereby the committee members took testimony and sought additional information from a number of constituents, including, but not limited to Mayors and city officials, airport personnel, lobbyists, consultants, officials from the North Dakota Aeronautics Commission (NDAC), and researchers from the Upper Great Plains Transportation Institute (UGPTI).

Bills related to aviation included an amendment to the current North Dakota Century code (Senate Bill 2278), allowing each public use airport to be provided assistance according to established guidelines and within the limits of appropriations from the state general fund. This bill expanded the use of general fund monies to all public use airports, including general aviation airports. Prior to this amendment, the NDAC was limited to providing monies only to those

airports served by at least one Federal Aviation Administration (FAA) certified airline, essentially limiting the use of the funds to commercial service airports. Senators Laffen, Andrist, Robinson, and Sorvaag and Representatives K. Koppelan and Trottier introduced the bill to expand use of state general funds to all airports. The bill was approved by both houses of the legislature and signed into law by the Governor.

Figure 4.1 Governor Dalrymple of North Dakota addresses the 63rd Legislative Session Source: Google Images, 2013

Recognizing the unprecedented growth in the oil and gas sectors in the western region of the state, Governor Dalrymple submitted a one-time, $60 million funding proposal to the legislature for infrastructure improvement for airports in the Bakken region (Figure 4.1). The Appropriations Committee introduced Senate Bill 2013, which authorized the director of the Energy Infrastructure and Impact Office to develop procedures to distribute grants to airports to support infrastructure needs. In addition, airports may request grants to meet the 10 percent cost-share requirements for federal monies for eligible projects with the FAA providing 90 percent of the remaining funds.

At the request of the Governor, the Appropriations Committee also introduced Senate Bill 2006, appropriating one-time funding for the 2013-2015 biennium from special funds in the amount of $6 million to the NDAC for the purpose of providing grants to airports. The bill requires the NDAC to report to the appropriations committee of the next legislative assembly on the distribution of grants. Historically, legislative appropriations to the NDAC for airport grants have ranged from $503,425 for the 1995-1997 biennium to $554,500 in 2011-2013 biennium, a change of just over 10 percent over 18 years. The one-time $6 million appropriation represents a significant increase in funding and widens the opportunities for financial assistance to airports that would otherwise have to do with little or no funding.

In addition, the state and federal governments addressed the significant increase in airline activity, congestion, and aircraft boarding at airports in the western region of the state. In the fall of 2013, officials at the Minot International Airport broke ground on a $40 million terminal enhancement as part of a larger capital improvement project that will cost nearly $70 million (Figure 4.2), with the state providing approximately $21 million or 30 percent of the project cost in grant funding. The new terminal will be approximately three times the size of the current terminal, measuring 115,000 square feet. The state is also providing funding to construct a terminal access road, apron for aircraft parking, and furniture for the new terminal at a cost of $2.5 million (North Dakota Office of the Governor, 2013).

Figure 4.2 Federal, State, and local officials break ground on a new $40 million terminal at Minot International Airport
Source: North Dakota Office of the Governor, 2013

4.2 Conclusion and Recommendation

The Federal Aviation Administration provides essential funding to airports through its Congressional authorization that helps airports construct, expand, and maintain their airport infrastructures. Federal funding is based on need and derived from activity at the airport, including, but not limited to scheduled flights, and number of enplanements. In 2012, the FAA provided record funding to airports in North Dakota in the amount of $51.1 million. This represented an increase of $22.6 million or 79 percent over the average of the previous 5 years from 2007 to 2011.

At the current rate of activity, North Dakota airports are qualified to receive federal funding at least at the 2012 level and federal funding could be increased for eligible projects provided the state continues to demonstrate need. However, the FAA's funding is subject to U.S. Congressional approval and therefore the outcome is dependent upon the passage of federal legislation that funds the nation's transportation systems.

Figure 4.3 Heavy truck traffic in the Bakken region of ND
Source: Google Images, 2012

During the 63rd North Dakota Legislative Assembly, airport operators, city and county officials, state agencies, and researches engaged the legislature in an effort to inform, educate and answer questions regarding the need to increase funding to airports. Research shows that in spite of the increased funding provided by the legislature for the 2013-2014 biennium, North Dakota airports will continue to have need for capital projects in excess of current funding levels for the next nine years.

To ensure that North Dakota airports can provide safe and efficient passenger air service, air charter, airfreight, air ambulance, and agricultural services, and to ensure that the tax payers of the state are provided an adequate return on their investment in the state's aviation infrastructure, the state's aviation systems will need $50 million per year of state funding in addition to federal and local investments. State funding would support maintenance and rehabilitation of aviation infrastructure at current and future safety standards, including but not limited to runways, taxiways, terminals, parking, and security. An estimated $5 million in state funding is needed over the next nine years for aviation projects that are not eligible for federal funding and for those airports that need financial assistance to meet the 10 percent match necessary to secure federal investments.

The aviation industry is an essential player in the state's economic vitality. Just as the state highways and roads connect oil and gas production facilities, airports transport travelers and equipment in the oil and gas industry between North Dakota and the rest of the world. Recognizing the impact of oil and gas production on surface transportation that results from heavy truck traffic on state and county roadways, the North Dakota legislature has committed to providing biennium funding to maintain and improve surface infrastructure (Figure 4.3). Likewise, similar funding is needed to support air transportation infrastructure that continues to play an essential role in the state's economic engine.