Airport Master Plan

Rapid City Regional Airport

October 2015 – FAA Submittal

KLJ

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Executive Summary

Scope & Timeline

The 2014 Rapid City Regional Airport Master Plan Update was prepared for the City of Rapid City in accordance with Federal Aviation Administration (FAA) standards and in consultation with the Airport Board, Staff, Tenants and Community Representatives. The development plans determined from this update provide the basis for projects to be considered in 5, 10, 20 years and beyond.

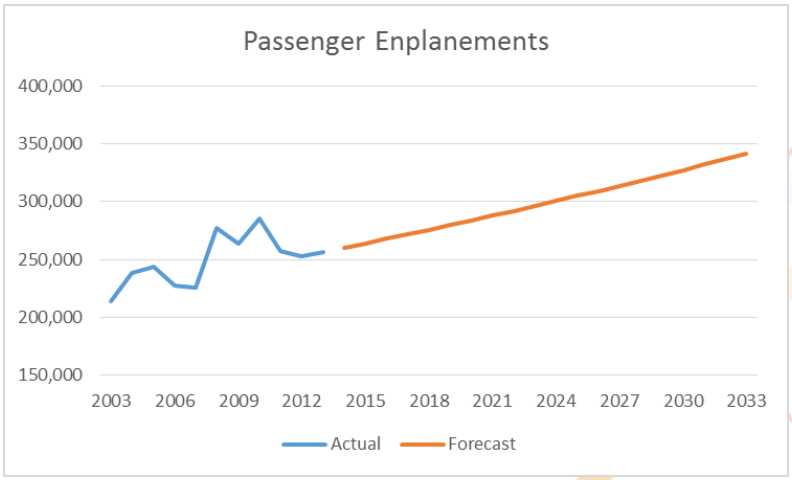
The project addressed all elements of the airport to meet projected demand. The following items were specific focus areas for this 2014 Airport Master Plan:

- Identify expansion areas for General Aviation
- Identify new Cargo area
- Determine Ultimate Runway Length
- Review Passenger Terminal size, inline baggage screening needs and deicing area
- Identify needs of USFS
- Identify location for ATCT

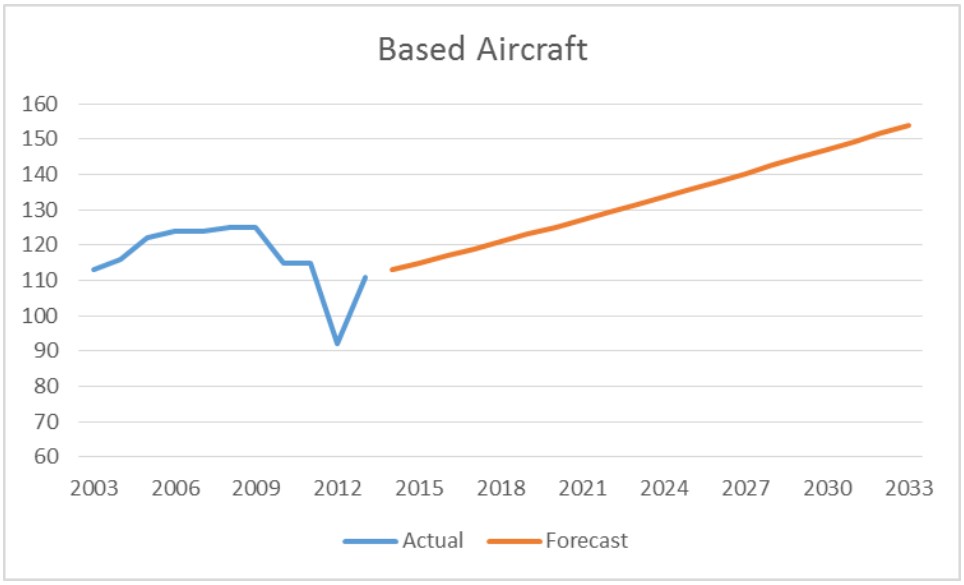
Master Plan Milestones	
Kick-Off	March 2014
Existing Conditions	July 2014
Forecasts	September 2014
Alternatives	May 2015
Electronic ALP	August 2015

Forecasts

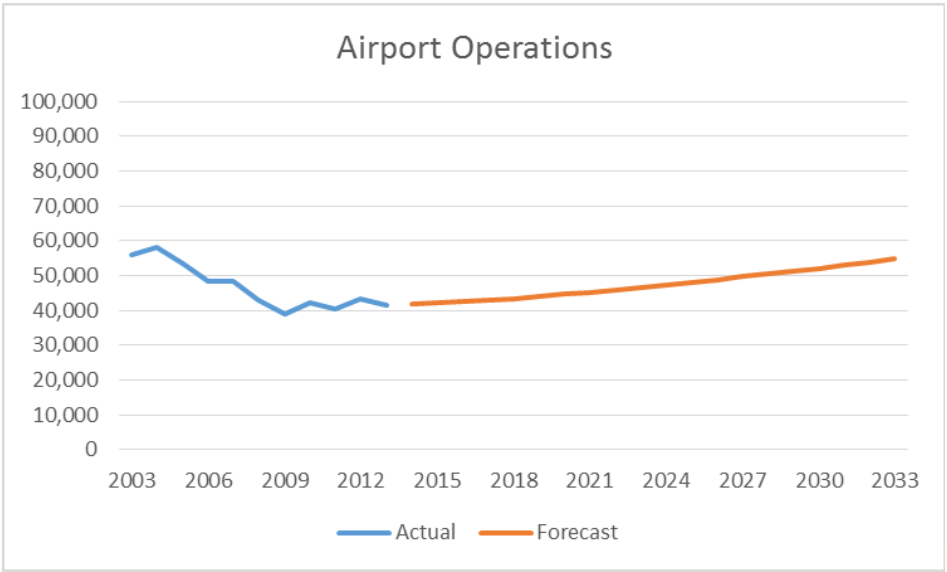
At the same time that existing facilities at the airport were examined a second effort was undertaken to determine what the demand would be for each type of aviation activity at Rapid City Regional Airport through the 20 year planning period. There are three key measures: 1) *passenger enplanements* which drive airline terminal capacity, 2) *based aircraft* which drive aircraft storage capacity and 3) *airport operations* which drive airfield capacity.



Passenger Enplanements, on an annual basis, have shown steady growth with periodic short term ups and downs. Enplanements are forecast to increase at a rate equivalent to the Rapid City MSA Employment growth. This 1.44% CAGR can easily be accommodated in the existing airline terminal.



Historical Based Aircraft numbers at Rapid City are reflective of various errors in data collection prevalent across the country until approximately 2009. The errors were not extraordinary but tending to show slightly more based aircraft than when strictly using the FAA criteria for counting. In 2009, the FAA began a multi-year process of confirming based aircraft and with the exception of a local data collection error in 2012, Rapid City had around 111 based aircraft which had plateaued due to lack of hangar space. If hangar space requirements are met, the based aircraft are forecast to rise at a 1.66% CAGR consistent with an increasing share of the Rapid City MSA population.

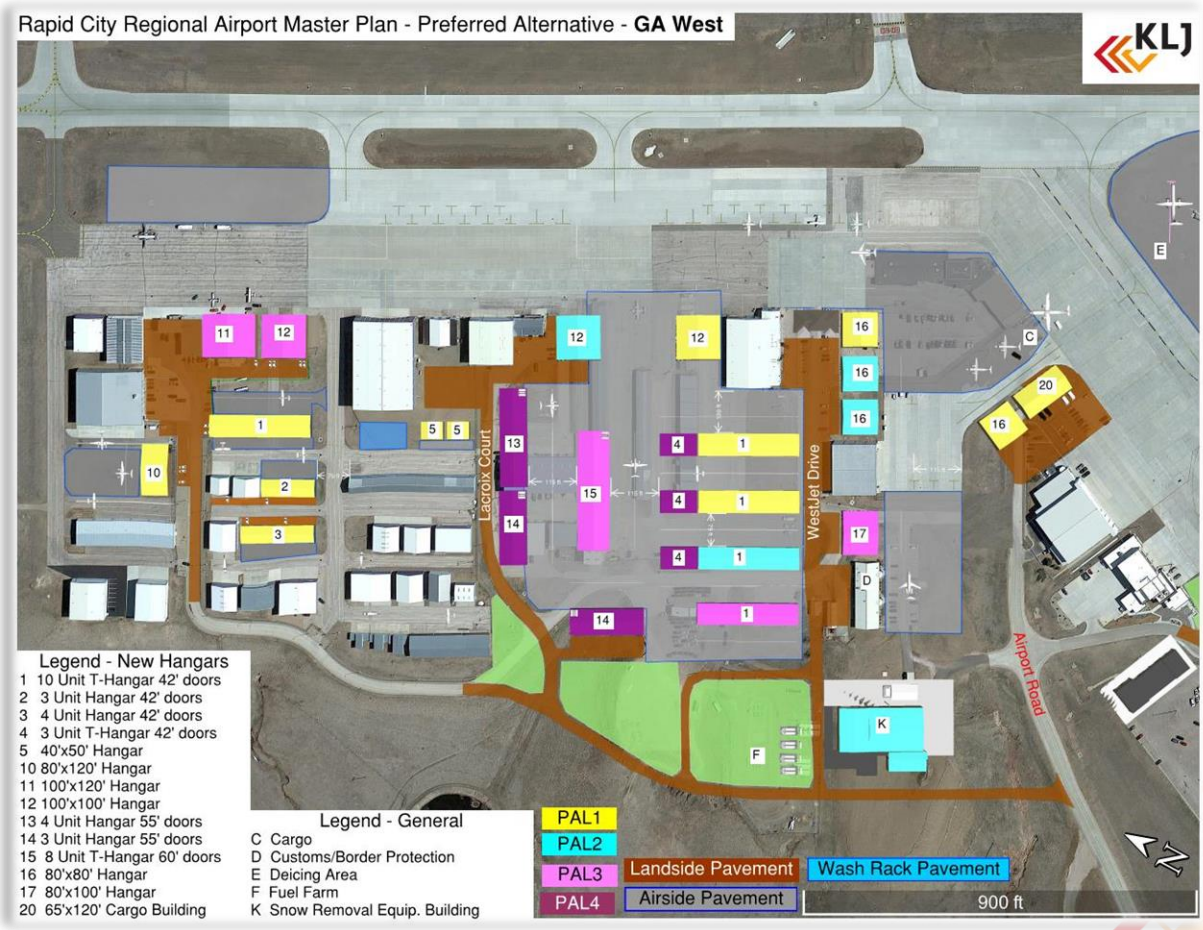


Airport Operations which are an aggregate of airlines, military, and general aviation, have declined somewhat particularly in the area of general aviation. This change is consistent in many parts of the country and a slow steady growth of 1.41% CAGR is expected when all areas of airline, military and general aviation operations are combined. For Rapid City this level of airport activity can be readily accommodated within the existing airfield with no substantial capacity improvements.

Preferred Alternative

There were six different concepts refined down to three alternatives for the airport to consider in selecting a preferred alternative. The preferred alternative was selected based on a layout that best met the demand for facilities in all aspects of aviation. Key elements of the preferred alternative were:

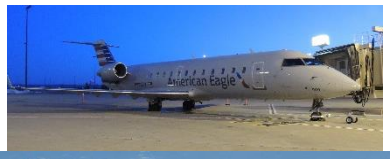
- New Cargo location
- New General Aviation Road alignment to accommodate hangar development
- Relocate Snow Removal Equipment facility to accommodate hangar development
- Hangar Development based on demand
- New Aircraft Deicing Pads
- Inline Baggage Screening System
- Parking expansion for public use and rental car storage
- Relocate ATCT to improve visibility from the tower
- Realign Long View Road to accommodate Precision Approach to Runway 14
- Precision Instrument Approach for Runway 14
- USFS expansion to south from current Air Tanker Base
- SDARNG expansion within existing leasehold
- Parallel taxiway on east side of Runway 14-32



Implementation Plan/Funding

The following table provides a timeline for the projects in the preferred development plan.

	Near-Term 0-5 Years PAL 1	Mid-Term 6-10 Years PAL 2	Long-Term 11-20 Years PAL 3 & 4	Ultimate 20+ Years Beyond PAL 4
Airfield	• Replace PAPIs • Remove Taxiway B between the Apron and Taxiway A	• Realign Long View Road outside of Runway 14 RPZ • Precision Instrument Approach for Runway 14 • Replace ATCT	• Add 25' paved shoulders for Runway 14-32 • Expand Blast Pad for Runway 32 to 200' x 200'	• Construct East Parallel Taxiway for Runway 14-32
Passenger Terminal	• Add inline Baggage Screening • Add new Baggage Makeup Area • Deicing Apron Phase I (1 position)	• Expand terminal apron to square off corners	• Deicing Apron Phase II (2 positions)	
General Aviation & Other	• Add 3 10-unit T-Hangars • Add 3 conventional hangars • Add 9 small box hangars • Add Cargo Building and Cargo Hangar • USFS Phase I	• Expand Apron on North end by 7,000 square yards • Add 1 10-unit T-Hangar • Add 2 Conventional Hangars • SDARNG Readiness Center • USFS Phase II	• Add 1 10-unit T-Hangar • Add 3 3-unit T-Hangars • Add 3 Conventional Hangars • Add 1 8-unit Exec T-Hgr • Add 10 small box hangars • USFS Phase III	<u>East Side</u> • Add 22,500 square yards of apron • Add 5 Conventional Hangars • Add 3 10-unit T-Hangars • Add 8 small box hangars
Landside	• Public Parking Lot Entry/Exit Shelters	• Realign Road for Rental car lot (for Terminal Apron expansion) • Pave Additional public parking • Add storage lot for rental cars	• Site work for non-aeronautical area	
Support	• New General Aviation Road	• Relocate Maintenance and SRE facilities • Sanitary Sewer connection	• Prepare CBP facility	





Cost Estimates for Preferred Alternative (000's)					
Area	**Description**	**Paving**	**Buildings**	**Other**	**Total**
West General Aviation	Hangars & Associated Paving	4,557.3	14,580.9		19,138.2
East General Aviation	Hangars, Paving & Utilities	3,902.5	6,476.2	1,807.7	12,186.4
East Taxiway	Paving	21,435.5			21,435.5
Terminal	Deicing Area; Apron Paving; & Parking	5,057.5	138.0	828.0	6,023.5
Cargo/CBP	Apron Paving, Fill and Buildings	569.0	1,495.0		2,064.0
USFS	Paving and Associated Fill	3,268.5		1,442.0	4,710.5
ATCT	Building and Associated Paving	63.0	3,450.0		3,513.0
SRE Building	Building and Associated Paving	521.3	8,964.5		9,485.8
Roads	New Roads in GA Areas & Realign Long View	2,730.1		1,841.0	4,571.1
	Total	$42,104.7	$35,104.6	$5,918.7	$83,128.0

Sources of Funding -- The development needs at the airport will make use several different funding sources for different elements of projects. Following is a description of those funding sources and potential uses:

- Airport Improvement Program (AIP) – from the FAA and used for eligible portions of airport projects which improve safety, capacity or preserve justified facilities. Funding is up to 90%.
- SD Aeronautics – from the SD DOT and used for 4-6% of the cost of an AIP Eligible project.
- Transportation Security Administration (TSA) – from the TSA and used for the eligible portion of the inline baggage screening system where bags are conveyed through the screening area.
- Other Federal Funds – the USFS and SDARNG are expected to pay for the improvements necessary for their facilities. AIP funds may not be used for these as there is a prohibition on using AIP to fund other federally used facilities.
- Passenger Facility Charge – authorized by the FAA for eligible portions of projects and funded from a $4.50 per passenger charge. Mostly dedicated at this time to repayment of the airline terminal remodeling.
- Customer Facility Charge – a charge to rental car customers used for improvements to rental car facilities. Mostly dedicated at this time to repayment of the Car Rental Quick Turn facility.
- Airport Revenues – all sources of airport funding which can be used for capital improvements. For the master plan this is expected to be the match for AIP projects, the ineligible portions of any projects, and the construction of small hangars for renting to aircraft owners.
- Private Funding – individuals and companies finance projects at airports in exchange for a leasehold interest in airport property. For the master plan this private funding is anticipated for large hangars which are typically unique to a business interest. The leasehold interest provided by the airport should be equivalent to the level of investment and its typical amortization.

Chapter 1: Introduction

Purpose and Scope

The information presented in this report represent the study findings for the 2014 Rapid City Regional Airport Master Plan Update prepared for the City of Rapid City. Airport Master Plans are prepared in accordance with Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*. The development plans determined from this project will be considered in the National Plan for Integrated Airport Systems (NPIAS) as it is managed by the FAA. This project is funded by the Rapid City Regional Airport with the intent to seek partial reimbursement from the Federal Aviation Administration (FAA) through a grant and thus complies with Federal requirements.

This Airport Master Plan Update for the Rapid City Regional Airport will serve as an updated guide for identifying future development necessary to accommodate existing and future aviation demand. The airport's current and forecast safety, capacity and compatibility needs are addressed in this study. Many projects have been completed and new planning considerations have developed since the previous Master Plan study in 2008.

The scope of the study was developed by the Rapid City Regional Airport and Kadrmas, Lee & Jackson (KLJ) in cooperation with FAA and state officials to identify the specific needs and objectives of the airport owner. The scope includes work tasks with the purpose of documenting existing conditions, forecasting future aviation activity levels, identifying future facility requirements, formulating and evaluating airfield alternatives, and preparing implementation plans. Recommendations will be made for improvements that are triggered by safety requirements or demand thresholds.

The project received notice to proceed in January 2014. The baseline project data is from inventory efforts completed in March 2014. Baseline airport operational data is from Federal fiscal year 2013 (October 2012 – September 2013). The Federal fiscal year time period aligns directly with the FAA Terminal Area Forecast. Discrepancies in historical data will be noted throughout the document.

The Airport Layout Plan for this Master Plan was adopted by the Rapid City Regional Airport on September 22, 2015.

Airport Master Plan Format

The required and recommended contents of Airport Master Plans are detailed per FAA standards. Effective airport master plans are based on the analysis of significant amounts of data, and many airport master plans typically present not only the planning conclusions, but all data and accompanying analysis in considerable detail.

This Master Plan presents extensive data to support the plan in a series of appendices. As the reader moves through the narrative descriptions, there are frequent references to specific appendices to provide additional details and information. In addition, internet hyperlinks are included to reference documents that are current as of the time of this report.

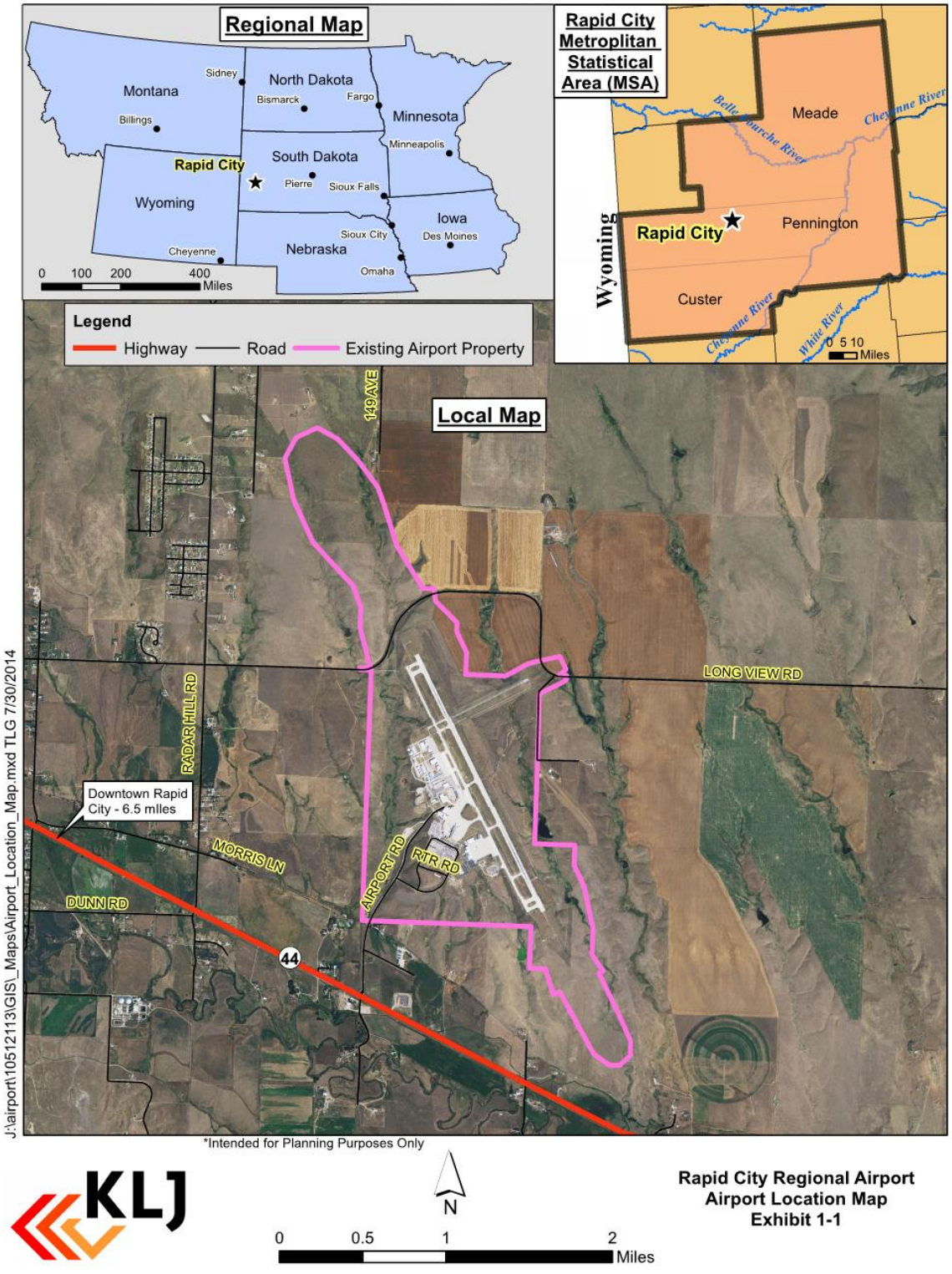
Background

Rapid City Regional Airport has been owned and operated by the City of Rapid City since 1950 when it was first established. Prior to the current location, the municipal airport was collocated at the Rapid City Army Air Base, now recognized as Ellsworth Air Force Base. The airport now encompasses 1,655 acres of land. The airport is located nine miles east of the Rapid City central business district. See **Exhibit 1-1: Airport Location Map**.

Since 1950, Rapid City Regional Airport has expanded to accommodate the aviation needs of the community, and has helped support the social and economic vitality of the City of Rapid City and the Black Hills region. The City is a regional commercial and business hub within an agricultural and tourism region of the country. Rapid City, first known as a hay camp, was laid out as a town in 1876 and has grown from a six block area to a community of nearly 70,000 people. Unemployment rate in Rapid City has historically been lower than the statewide and national figures. Health care, retail and financial trade sectors make up the majority of employers in the Rapid City area. Growth in tourism, travel related to Ellsworth AFB, and thriving local businesses in health care, financial, and agricultural-related businesses are seen locally as significant contributors to increased airport use and passenger enplanements.

Rapid City Regional Airport is the second largest airport in the state of South Dakota serving four domestic airlines flying to nine non-stop destinations. The airport enplaned 263,560 passengers in Federal Fiscal Year 2013 making the airport classified as a non-hub primary commercial service airport by FAA. The terminal building was constructed in 1989 and renovated in 2013 to accommodate growing passenger demands.

Exhibit 1-1 – Airport Location Map



Planning Considerations

Planning considerations for an airport master plan are features, elements or events that should be evaluated because they have the potential to affect the airport facility over the long term.

Previous Master Plan

Since 1991, the Airport has historically completed Master Plan studies or updates every five to seven years. The last Master Plan for Rapid City Regional Airport was completed in 2008 which included a variety of items. The 2008 Master Plan study recommended several improvements including:

Projects Completed

- Relocate the airport rescue and fire fighting facility to provide space for aeronautical uses and ensure compliance with grant assurances.
- Straighten Taxiway A to correct a modification to FAA standards and provide increased aircraft parking.
- Construct a rental car preparation facility.
- Provide additional aircraft parking with new apron.
- Improve terminal facilities including expanded passenger holdrooms, expanded and reconfigured passenger security screening.

Projects In-Process

- Relocate the Northern Great Plains Interagency Dispatch Center to allow for space for aeronautical uses and ensure compliance with grant assurances.

Projects Not Completed

- Replace existing and construct additional T-hangars.
- Construct 30 additional conventional hangars.
- Construct 550 rental car spaces for overflow/storage parking with future expansion for an additional 1,100 vehicles.
- Construct up to 650 additional parking spaces for long term passenger, employee, and rental car parking.
- Relocate airport maintenance facilities to promote space for aeronautical uses.
- Improve terminal facilities to improve checked baggage security screening.
- Extend Runway 32 500 feet to meet the needs of existing users.
- Develop an area dedicated to cargo operations to enhance safety, increase security, and provide for future growth.
- Replace the air traffic control tower to improve airfield visibility.
- Provide for U.S. Forest Service facility growth.
- Plan for extension of the terminal concourse.

While many of the improvements proposed in the 2008 master plan have been constructed, there are others that remain. In addition changes in demand continue to occur which necessitates the need to update the Master Plan study to identify priority projects to meet on-going aviation needs.

Local Considerations

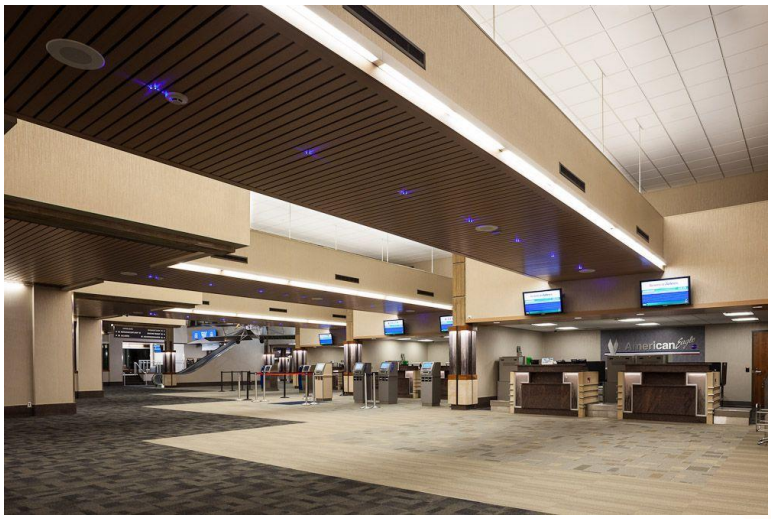
Between 2008 and 2014, the airport has seen many changes that affect airport planning. Some planning considerations from the previous Master Plan are still applicable today.

Development Constraints

The airport is in an open area without significant development. The airport is however constrained in that it is situated on a low plateau and any development requires a significant amount of fill. The airport has typically developed only as additional land is made suitable creating, particularly in the general aviation and US Forest Service areas, an amoeba like movement of buildings westward as land slowly is filled.

Passenger Terminal Complex

Rapid City Regional Airport has seen growing passengers as a result of increased demand and additional flights provided by the airlines. As a result, the airport continues to have a need for additional parking particularly during the summer tourist season. In addition, parking for rental cars is also constrained during the summer tourist season. A new rental car quick turn-around facility was completed which also removed some rental car parking. A need for additional parking spaces continues to exist for rental car overflow parking.



The terminal building was remodeled in 2013 with significant improvements for passenger screening, rental car and baggage claim areas and general updating. There remains a need to accommodate space for checked baggage screening. This is currently done behind each ticket counter and the need for an in-line baggage screening system was identified in the 2008 Master Plan. This plan will reexamine this need with a particular focus on a preferred alternative and implementation timeline.

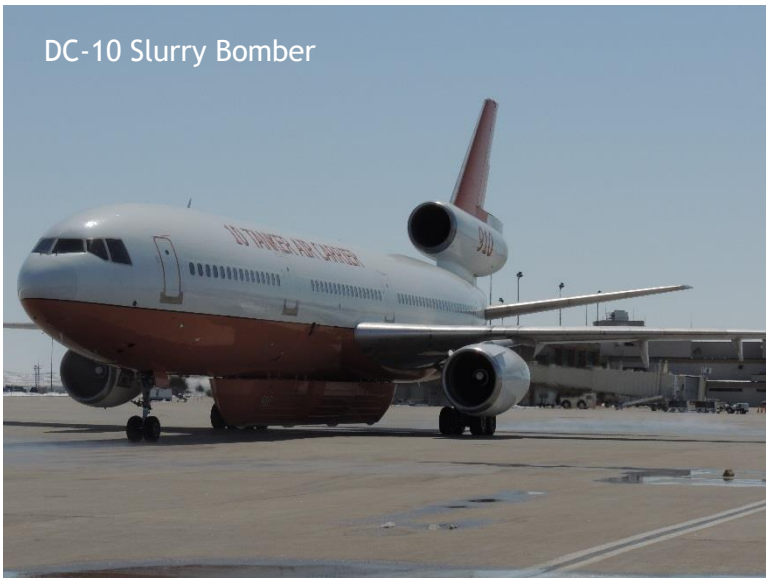
Air Cargo

Air cargo is currently handled at two separate locations, one near the old terminal building and the other on the north end of the general aviation apron. The old terminal building is being removed (2014-15) and a new location must be identified for air cargo to allow this

area to be redeveloped. There would be benefits from identifying a principle location for air cargo and providing good airside and landside access.

Army National Guard and US Forest Service

The South Dakota Army National Guard (SDARNG) and U.S. Forest Service (USFS) each occupy space immediately to the south of the airline terminal. The mission of the National Guard facilities at the airport have not changed, however the facility has recently completed a Master Plan and any planned facilities need to be incorporated into the airport planning efforts.


DC-10 Slurry Bomber

The USFS operates an air tanker base at the airport and currently can only fill one aircraft at a time with a first in, first out loop taxilane. The USFS is seeing changes in their fleet mix which will necessitate a change in facilities to accommodate increased aircraft sizes.

Community Growth

The City of Rapid City and surrounding area is projected to continue to grow at a steady rate of about 2 percent per year. This increase in population and business growth will likely translate into additional demand for the passenger terminal, air cargo, general aviation and support facilities at the Rapid City Regional Airport. Updated facility requirements are necessary for the airport to continue to grow to meet these community aviation needs.

A graphical representation of the planning considerations for this Master Plan study is shown on **Exhibit 1-2 - Planning Considerations Map**.

Planning Objectives

With the completed Master Plan projects, continued increase in activity, and constraints on airport development, the Rapid City Regional Airport authorized an update to the Master Plan. The Airport contracted with KLJ to prepare an update to the Airport Master Plan to examine options for the airport to address the planning considerations, including developing and analyzing alternatives and recommending a course of action.

Based on the background and planning considerations, the planning objectives for this study identify the methods used to meet the airport development goals outlined by the Rapid City Regional Airport. The objectives are identified as follows:

- General Aviation Development – functionality & expansion alternatives
- Cargo Needs – functionality & optimal location for aircraft and vehicles
- Evaluate non-aeronautical development on airport property
- Runway Length & Alternatives when Primary Runway is out of service
- Passenger Terminal Building Needs
    - Inline baggage screening
    - Review Terminal Apron Size
    - Deicing Facility Implications
- Public Automobile Parking Needs
- US Forest Service Aerial Firefighting Base – functionality & expansion alternatives
- Relocation of Airport Road in General Aviation area
- Evaluate Snow Removal Equipment & Maintenance Facilities
- Siting options for Air Traffic Control Tower
- Update Land Use Compatibility
- Coordinate Master Plan with City and City Comprehensive Plan

Legend

- Existing Airport Easements
- Existing Airport Property
- Existing Runway Protection Zone

N

0 250 500 1,000 Feet

*Intended for Planning Purposes Only

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Rapid City Regional Airport
Planning Considerations Map
Exhibit 1-2

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The Master Plan will also consider the following objectives as the process is undertaken:

- Review financial options for funding the Airport Capital Improvement Plan.
- Justify the proposed development through the technical, economic, and environmental investigation of concepts and alternatives.
- Provide an Airport Layout Plan identifying existing and proposed airport development.
- Establish a realistic schedule for the implementation of the development proposed in the plan, particularly the short-term capital improvement program.
- Propose an achievable financial plan to support the implementation schedule.
- Identify subsequent environmental evaluations that may be required before a proposed project is approved.

Master Plan Process

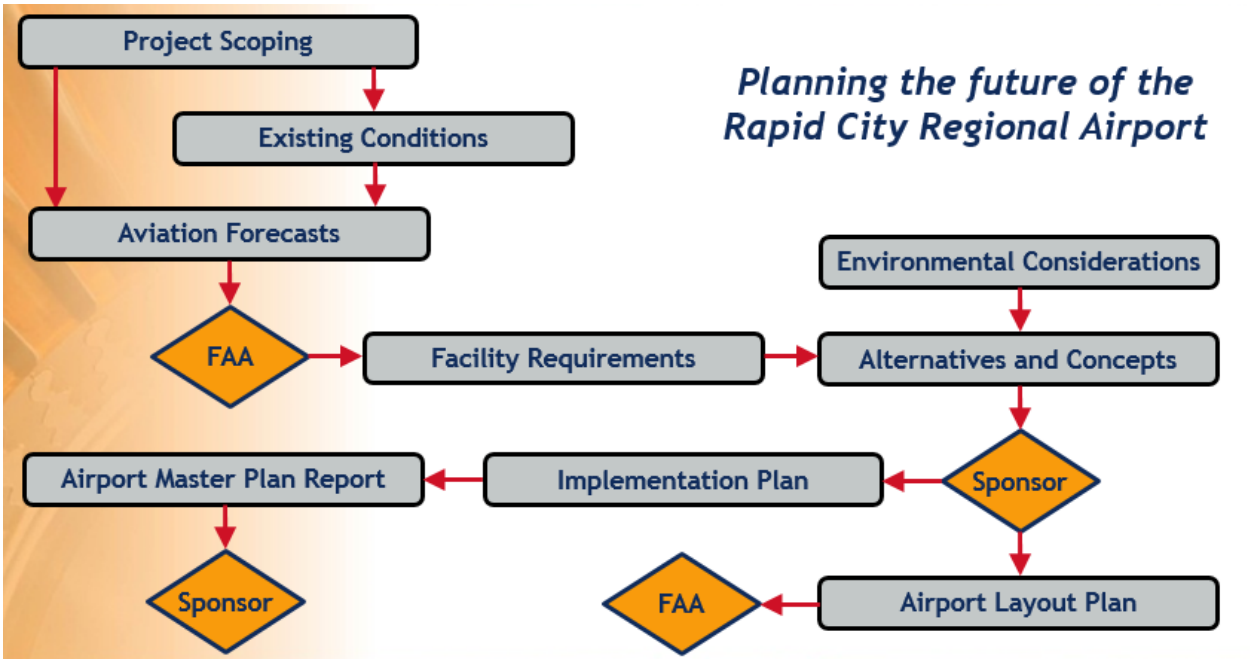
Guidelines for completing a Master Plan are set forth in FAA Advisory Circular 150/5070-6B. Each master plan study scope and level of effort is customized to fit each individual airport's needs and address critical issues. The recommendations made in the study allow airports to address key issues to allow for safety, capacity and compatibility to meet airport demands and community needs. Plans are flexible to provide demand-driven triggers for improvements.

The Airport Master Planning process involves several coordinated steps. The master plan study for Rapid City Regional Airport consists of the following elements:

- **Pre-Planning** – Airport development concerns are identified and planning objectives prepared to address these issues. An overall vision for the study is formulated that will guide the process.
- **Inventory of Existing Conditions** – Overview of airport setting, infrastructure and assets which includes airside, landside and support facilities; airspace, navigational aids and airport access.
- **Forecast of Aviation Demand** – Using established forecasting methods, estimate current and project future airport activity for general aviation, air cargo, and passenger enplanements.
- **Demand/Capacity Analysis and Facility Requirements** – Compare the existing capacity with the future demand and identify the facility requirements to satisfy the aviation safety, capacity and compatibility needs.
- **Alternatives Development and Evaluation** – Identify and evaluate options considering both on-airport and off-airport impacts consistent with the study goals and objectives. A preferred alternative is selected.
- **Environmental Overview** – Provide an overview of anticipated environmental impacts as part of the development of alternatives.
- **Implementation Plan** – Provide a comprehensive plan for implementation of the preferred alternative including project triggers, sequencing, and cost estimates.
- **Land Use Compatibility** – Complete a comprehensive review of land surrounding the airport for potential uses that are incompatible with safe airport operations and provide mitigation recommendations.

- **Airport Layout Plan** – Document the existing and planned airport facilities through a set of drawings approved by the airport sponsor, state and FAA.
- **Stakeholder and Public Involvement** – Prepare and execute a plan to engage important airport stakeholder and the public throughout the study to gather their input and address their concerns.

Exhibit 1-3 – Airport Master Planning Process Flowchart



Source: KLJ

Study Documentation & Approvals

The Master Plan Update was divided into chapters of information to document airport planning data, analysis, findings and recommendation of the study. The chapters included in the narrative report are the following:

- Chapter 1 – Introduction
- Chapter 2 – Existing Conditions
- Chapter 3 – Forecasts
- Chapter 4 – Facility Requirements
- Chapter 5 – Alternatives Development and Evaluation
- Chapter 6 – Implementation

Each narrative report chapter was prepared separately and distributed to the Rapid City Regional Airport staff initially for review. After airport staff review, each draft chapter was made available to key airport stakeholders for input prior to a final review and approval by the Rapid City Regional Airport Board. Each approved final draft chapter was then published on the airport's website for any final public comments.

In addition to the chapters there are a number of appendices[1] in this Master Plan. The list of appendices are as follows:

- Appendix A – Glossary of Terms
- Appendix B – Master Plan Process
- Appendix C – Public Involvement
- Appendix D – Airport Classification
- Appendix E – Airport Funding
- Appendix F – Airport Background
- Appendix G – Airfield Pavements
- Appendix H – Airfield Design
- Appendix I – General Aviation & Other Users
- Appendix J – Support Facilities
- Appendix K – Navigational Aids
- Appendix L – Airspace and Instrument Approaches
- Appendix O – Land Use Compatibility
- Appendix P – Environmental Overview
- Appendix T – Terminal Facilities
- Appendix U – Solid Waste Management Plan

In addition, an Executive Summary report has been prepared at the end of the master plan study to concisely document the recommendations of the study. This document was distributed to airport stakeholders and made available on the airports website.

The Rapid City Regional Airport Board provided master plan study approvals progressively thorough the project during their public meetings. The Airport Layout Plan for this Master Plan Update was adopted by the Rapid City Regional Airport on September 22, 2015. The Airport Layout Plan was submitted to FAA for review and approval on October 9, 2015.

Public Involvement

Public involvement is a key component to the successful development of an Airport Master Plan study. The purpose is to encourage information sharing and feedback from airport stakeholders including the airport owner, airport users/tenants, local government officials, resource agencies, elected and appointed officials and the general public. Public involvement provides valuable input to assist the airport owner in decision making and develop consensus on study conclusions.

Airport focus groups were established to provide input throughout the life of the study. The purpose of establishing focus groups was to facilitate group discussion and feedback from stakeholders groups. The sponsor chose this method over a technical advisory committee

[1] The lettering of appendices is based on a KLJ standard structure for Airport Master Plans and therefore some appendices letters may not be used depending on the specific project.

made up of stakeholder representatives. Focus groups represented the following airport stakeholders:

- General public
- Local Government
- Airport/Airlines/TSA/FAA
- Air Cargo
- General Aviation
- Airfield Tenants
- Terminal Tenants
- South Dakota Army National Guard
- U.S. Forest Service

Focus groups were invited and attended kickoff meetings with the purpose of providing a summary of airport inventory items and planning considerations. These meetings were held on March 12-14, 2014. Members of the focus groups received copies of draft study documentation for review and comment. A call for input was made during the inventory, facility requirements and alternatives stage for more detailed input to assist the Rapid City Regional Airport with decision making.

A Public Open House was held at two points during the master plan study; kickoff (March 13, 2014) and recommendations May 6, 2015. An Open House provided a forum for the Airport to share information on the study and solicit feedback from the public. The public was also invited to Airport Board meetings to provide feedback progressively during this project. Draft documents on the study were posted progressively for public review. An online comment form ran throughout the life of the project for provide the public with another forum to provide comments.

Study meetings with the Airport staff were held at key stages throughout the project to facilitate small group collaboration and feedback on study elements. See **Appendix C - Public Involvement** for copies of public involvement meeting agendas and summaries.

Conclusion

This Airport Master Plan Update study for the Rapid City Regional Airport provides the City of Rapid City with a usable guidance document to assist with decision making with airport capital improvements to meet aviation demands for the foreseeable future. As with any planning study, assumptions made are subject to change due to unpredictable internal and external events. For this reason, this study should be reviewed periodically to verify project scope and triggering events are still valid to meet the airport needs.

Chapter 2: Existing Conditions

The Existing Conditions chapter of the Airport Master Plan for Rapid City Regional Airport provides the baseline framework to evaluate the airport facility. This chapter will be used to compare the existing facilities to the airport needs determined in future sections of the plan. This will lead to a plan developed for the future of the airport. Background information and data is gathered from various sources and compiled into this chapter and appendices. Please refer to the various appendices referenced within this narrative for more detailed information.

Background

General

Rapid City Regional Airport (FAA ID: RAP), South Dakota's second busiest airport is located in Pennington County in western South Dakota. The airport is a commercial service airport providing scheduled passenger service, overnight cargo, and complete general aviation services. The airport served 41,908 operations, enplaned 263,560 passengers and handled 3.2 million pounds of landed freight and mail in Federal fiscal year 2013.

Location

Rapid City is located in western South Dakota, the county seat of Pennington County. Rapid City is the second largest municipality within South Dakota and is located on the eastern edge of the Black Hills Range.

Rapid City is approximately 320 miles west of Sioux Falls, South Dakota; 300 miles north-northeast of Denver, Colorado; 280 miles southeast of Billings, Montana; and 220 miles southwest of Bismarck, North Dakota. Rapid City is approximately 25 miles northeast of the Mount Rushmore National Memorial and 40 miles west of Badlands National Park.

The airport is located nine (9) miles east of the Rapid City central business district. South Dakota Highway 44 provides access to the airport. This generally east-west thoroughfare provides direct access to downtown Rapid City. The airport is 4 miles south of Box Elder, South Dakota which is accessible via 8 miles by local roads or 14 miles by State highway and Interstate highway. Currently there is no direct access from Interstate I-90 to the airport.

The airport is in the Rapid City limits, but is not contiguous to the remainder of the City of Rapid City. The airport is subject to city zoning and permitting. The airport receives Aircraft

Rescue and Firefighting and Police services from the City of Rapid City. These services are paid for by the airport solely from airport funds.

Exhibit 1-1: Airport Location Map located in Chapter 1 depicted the airport's location locally and regionally.

Setting

Rapid City Regional Airport is situated in an agricultural area with residential developments in various locations to the west of the airport. Terrain is generally grasslands with low plateaus, ravines, broad valleys and a ridge line to the north of the airport. The airport sits on the top of a plateau, which adds to the ability to have clear approaches, but could possibly restrict the airports ability to grow because developable land is restricted. **Exhibit 2-1- Surrounding Land Use** depicts the airport's local environment.

Climate

Rapid City features a steppe climate, characterized by westerly winds and larger temperature fluctuations than in areas at the same latitude near oceans or seas. As a result, the Rapid City area commonly experiences periods of arid weather in the summer, short spring and autumn seasons and cold and dry winters. Warm "Chinook" winds and frequent sunny days make the Black Hills area the warmest part of the State in the winter. During the summer months, the Black Hills area frequently experiences cooler temperatures than the rest of the State. The prevailing winds in Rapid City are northwest, averaging 11.2 miles per hour. The highest average temperature for July is 87.1 Fahrenheit. The daily average temperature in July is 72.6 Fahrenheit.

The last annual freeze typically occurs in April and the first annual freeze occurs in October. January has the lowest average temperature at 12.9 Fahrenheit. Average annual precipitation is 16.29 inches.

Table 2-1 – Average Weather Conditions

Average Weather Conditions				
Month	**High Temperature**	**Low Temperature**	**Precipitation (Inches)**	**Snow (Inches)**
January	37.1	12.9	0.3	4.4
February	39.6	15.1	0.4	5.8
March	47.9	22.9	0.9	8.7
April	58.3	31.8	1.8	7.9
May	67.8	42.1	3.2	1.1
June	77.8	51.2	2.5	-
July	87.1	58.1	1.9	-
August	86.4	56.6	1.6	-
September	75.6	46.0	1.3	0.2
October	61.4	34.1	1.4	1.6
November	47.0	22.1	0.5	6.0
December	36.9	13.0	0.4	5.4

Source: National Weather Service

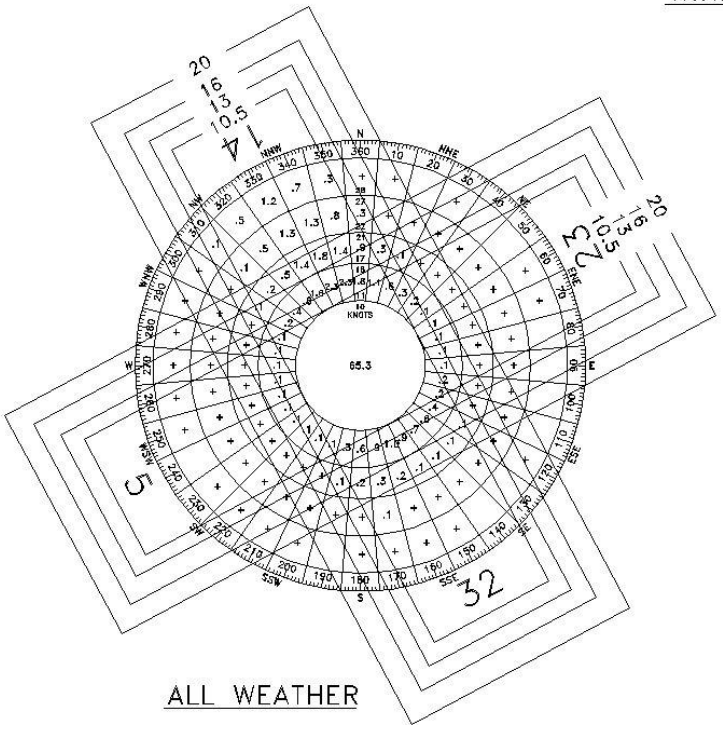
Prevailing winds during the summer are from the south and during the winter the prevailing winds are from the northwest; this is aligned with the airport's runway configuration. The current all-weather combined wind coverage of all runways exceeds FAA minimum recommendations of 95 percent.

Table 2-2 – Wind Analysis

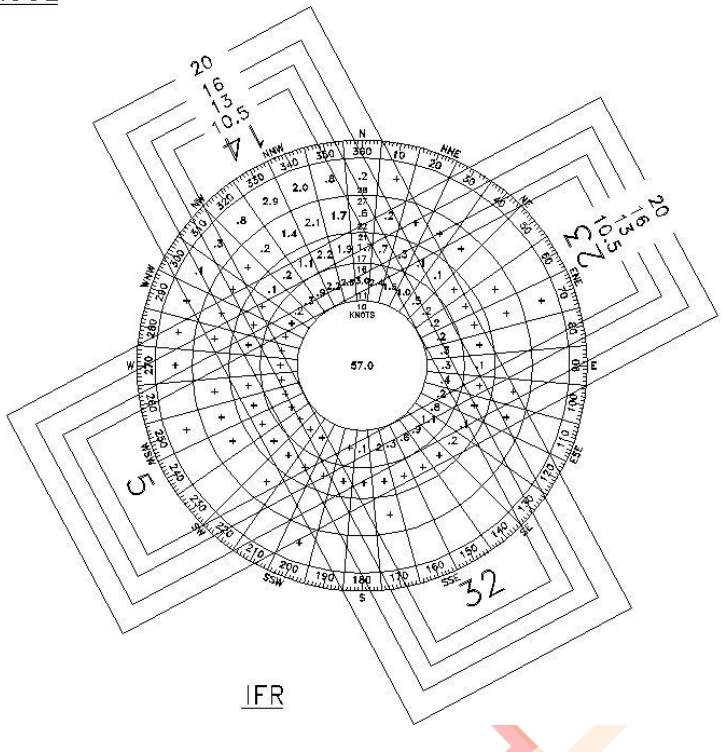
All-Weather Wind Coverage				
Runway	**Crosswind Component (Wind Speed)**			
	10.5 knots	**13.0 knots**	**16.0 knots**	**20.0 knots**
Runway 14/32	95.97%	98.16%	99.40%	99.82%
Runway 5/23	70.18%	77.24%	85.32%	91.35%
Combined*	98.22%	99.47%	99.88%	99.98%
IFR Wind Coverage				
Runway	**Crosswind Component (Wind Speed)**			
	10.5 knots	**13.0 knots**	**16.0 knots**	**20.0 knots**
Runway 14/32	93.06%	97.00%	99.16%	99.77%
Runway 5/23	64.33%	71.65%	79.26%	85.69%
Combined*	96.58%	98.81%	99.66%	99.95%

**Combined assumes up to maximum design aircraft crosswind component for each runway*
Source: National Climatic Data Center data from Rapid City Regional Airport (2004-2014)

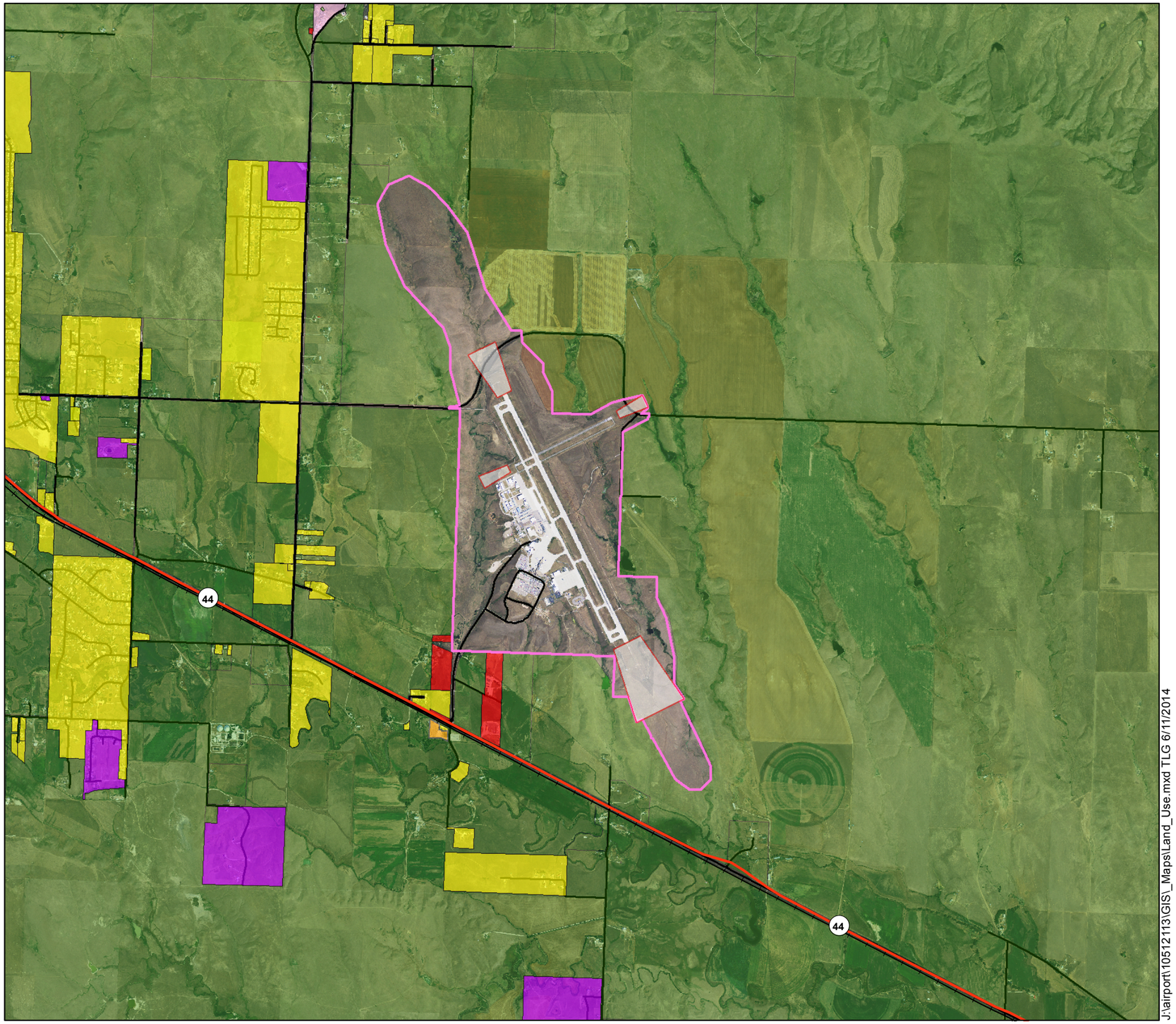
WINDROSE



ALL WEATHER



IFR



Legend

- Agriculture
- Commercial
- Highway Services
- Industrial
- Planned Unit Development
- Residential

Legend

- Highway
- Railroads
- Roadway
- Airport Property
- FAA Runway Protection Zone

N

0 2,000 4,000 8,000 Feet

*Intended for Planning Purposes Only

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Rapid City Regional Airport
Land Use Map
Exhibit 2-1

Demographics

Rapid City has an estimated population of 69,854 as of July 1, 2012[1] The Rapid City region is steadily growing; population in Rapid City has increased at an average annual growth rate of 1.43 percent since 2000. This compares to a South Dakota statewide population growth rate of 0.8 percent.

Table 2-3 – Population Summary

Population Summary				
Year	**Rapid City**	**Rapid City MSA***	**South Dakota**	**United States**
2000	59,607	112,818	754,884	281,421,906
2010	67,969	134,598	814,180	309,326,225
2012 (est.)	69,943	138,781	833,354	313,914,040
Annual Growth Rate	*1.43%*	*1.92%*	*0.83%*	*0.91%*

**Includes Pennington, Meade and Custer counties as defined by U.S. Census Bureau*
Source: U.S. Census Bureau

Economy

The Rapid City area has an economy that is primarily driven by agriculture, tourism, Ellsworth AFB, regional retail and regional medical. The city serves a regional trade area of approximately 460,000 people within a 200 mile radius. Unemployment rate within the Rapid City MSA as of July 2012 was 4.2 percent as compared to the South Dakota statewide rate of 4.2 percent and the United States rate of 8.2 percent. Unemployment rate in Rapid City has historically been lower than the statewide and national figures. Federal government, health care, retail and financial trade sectors make up the majority of employers in the Rapid City area. These industries, along with higher capture rates, have contributed to increased airport passenger activity.

Table 2-4 – Rapid City Major Employers

City of Rapid City Major Employers (2012)		
Employer Name	**Industry**	**No. of Employees**
Ellsworth Air Force Base	Government/Military	5,069
Rapid City Regional Hospital	Hospital/Health Care	3,602
Federal Government	Government (various)	2,954
City of Rapid City (includes seasonal workers)	Government (various)	1,906
Rapid City School District	Education	1,692
Wal-Mart/Sam's Club	Retail	1,205
State of South Dakota	Government (various)	1,171
South Dakota Army National Guard	Government/Military	1,025
Pennington County	Government (various)	628
Black Hills Corporation	Manufacturing	555

Source: Rapid City Economic Development (2012)

[1] U.S. Census Bureau (2014)

Table 2-5 – Rapid City Area Employment

Employment by Industry – Rapid City (2012)	
Industries	**Percent of Total**
Educational services, and health care and social assistance	24.90%
Retail trade	12.80%
Arts, entertainment, and recreation, and accommodation and food services	12.30%
Professional, scientific, and management, and administrative and waste management services	8.80%
Finance and insurance, and real estate and rental and leasing	7.80%
Construction	7.00%
Manufacturing	6.50%
Public administration	4.80%
Transportation and warehousing, and utilities	4.00%
Other services, except public administration	3.60%
Wholesale trade	3.30%
Information	2.60%
Agriculture, forestry, fishing and hunting, and mining	1.60%
All Industries	**100%**

Source: U.S. Census Bureau

Per Capita Personal Income (PCPI) in 2012 for the Rapid City MSA is $42,669 which is little less than the statewide average of $45,381 and slightly less than the United States average of $43,735.

Table 2-6 – Demographic Summary

Demographic Summary (2012)				
Demographic	**Rapid City**	**Rapid City MSA**	**South Dakota**	**United States**
Unemployment Rate	4.2%	4.5%	4.2%	8.1%
Per Capital Personal Income	-	$42,669	$45,381	$43,735

Source: South Dakota Department of Labor and Regulation, Bureau of Economic Analysis, Bureau of Labor Statistics

Chapter 3: Forecasts contains demographic and socioeconomic data, estimates, and forecasts.

Airport History

A brief history of the airport and its tenants is included in **Appendix F – Airport Background.**

Airport Management

The city of Rapid City owns and operates Rapid City Regional Airport. A five-member board of directors makes policy decisions for execution by Airport staff concerning Airport business affairs. The board members are appointed by the mayor of Rapid City which are confirmed by the Rapid City Common Council. The Airport Board is a semi-autonomous board, which operates the Airport on behalf of Rapid City. They are responsible for the general oversight of the airport. They have the ability to sign contracts on behalf of Rapid City and authorize the

expenditure of funds needed to operate the airport. The Board relies on staff members which include the Executive Director, three Deputy Directors who oversee Operations & Security, Maintenance & Facilities, and Finance & Administration, and various maintenance, operations and administrative personnel, for daily operation of the airport and addressing air service issues. Further information regarding Airport Governing and Management Structures is included in **Appendix F – Airport Background**.

Airport Role & Design

Rapid City Regional Airport provides scheduled passenger service, overnight cargo and complete general aviation services. The airport serves western South Dakota. The airport commonly draws commercial passengers from a catchment area within 125 miles. Competing commercial service airports include Chadron Airport in Chadron, Nebraska (102 miles) and Gillette-Campbell Airport in Gillette, Wyoming (141 miles).

The airport is part of the National Plan of Integrated Airport Systems (NPIAS) as classified by the Federal Aviation Administration (FAA). NPIAS airports are vital to the national air transportation system. According to FAA standards, the airport is classified as a non-hub primary commercial airport enplaning more than 10,000 enplanements but less than 0.05 percent of national total. **Appendix D – Airport Classification** contains more information on this topic with **Appendix E – Airport Funding** providing additional information about the Federal funding programs available to airports. The airport is certificated under FAR Part 139 guidelines as a Class I airport certificated to serve scheduled operations of large air carrier aircraft.

Airports are designed to regularly accommodate aircraft up to certain wingspan, tail height, and approach speed parameters. The last Airport Master Plan prepared for Rapid City Regional Airport in 2008 has a FAA Airport Reference Code (ARC) of C-III for an Airbus A320. The taxiway design group (TDG) for these aircraft is TDG-3. See **Appendix H – Airfield Design** for more details on FAA design classifications.

Airport Operators

Scheduled Passenger Airlines

Rapid City Regional Airport is served by four (4) commercial air carriers and/or their regional subsidiaries; Allegiant, American, Delta, and United. Scheduled direct flights are currently available to nine (9) cities including hub airports where connections may be made to hundreds of destinations worldwide. Scheduled airlines currently serve the Rapid City Regional Airport with jet and turbo prop aircraft as large as 166 seats (MD-83) and 156 seats (Airbus A319). The airport served 263,560 passengers in Federal fiscal year 2013. A complete flight schedule and aircraft fleet mix from March 2014, July and December 2013 can be found in **Appendix F – Airport Background.** See **Chapter 3 - Forecasts** for more

detailed information on existing and projected scheduled air service activity. The schedule below details the peak month activity (July 2013).

Table 2-7 – Scheduled Airline Flights

Rapid City Regional Airport –Scheduled Airline Service			
Airline	**Destination**	**Frequency**	**Aircraft Type (Seats)**
Allegiant Airlines	Las Vegas	1 to 2/week	MD-80 (166 seats)
Allegiant Airlines	Phoenix/Mesa	2 to 3/week	MD-80 (166 seats)
American Airlines	Dallas/Ft. Worth	2/day	ERJ-145/CRJ200 (50 seats)
American Airlines	Chicago O'Hare*	1/day (seasonal)	ERJ-145 (50 seats)
Delta Airlines	Minneapolis/St. Paul	4 to 5/day	CRJ200/CRJ900/MD90/A320 (50, 76, 160, and 180 seats)
Delta Airlines	Salt Lake City	1 to 2/day	CRJ200
Delta Airlines	Atlanta*	1/day (seasonal)	CRJ900 (90 seats)
United Airlines	Chicago O'Hare*	3/day (seasonal)	ERJ-145 (50 seats)
United Airlines	Denver	5 to 6/day	ERJ-145/Q400 (50 and 74 seats)
United Airlines	Houston Intercontinental*	1/day (seasonal)	ERJ-145 (50 seats)

**Indicates seasonal destination, **Frequency changes on weekends*
Source: Rapid City Regional Airport

Scheduled Cargo Carriers

Two (2) cargo carriers have facilities at the Rapid City Regional Airport; FedEx (Empire Airways) and UPS (Encore). FedEx feeder aircraft is the ATR-42 aircraft. UPS feeder aircraft include Fairchild Metroliner III, and Cessna 404/402 twin engine aircraft. The airport handled over 3.2 million pounds of cargo in 2012. Details of the existing conditions and future for these activities are included in **Appendix I - General Aviation & Other Uses.**

Army National Guard

South Dakota Army National Guard (SDARNG) operates a facility located directly southeast of the terminal complex of the airport. The mission of the SNARNG at the airport is medical transport and air cargo transport. The SDARNG facilities consists of a large apron (33,000 square yards), a fuel farm and three (3) buildings. Details of the existing conditions and future for these activities are included in **Appendix I - General Aviation & Other Uses.**

United States Forest Service Air Tanker Base

The United States Forest Service (USFS) operates a facility directly southeast of the SDARNG. The current layout is a loop system, which is only able to load one aircraft at a time. The USFS is anticipating MD-87 Tankers as early as the summer of 2014 which cannot be accommodated in the current configuration. USFS also has a need to be able to park aircraft for storage but the only space available is the GA apron area, which is located far north. Details of the existing conditions and future for these activities are included in **Appendix I - General Aviation & Other Uses.**

General Aviation

General Aviation comprises the remainder of the use of the Rapid City Regional Airport. In general the airport is home to one Fixed-Base Operator (FBO) WestJet Air Center, and nine Specialized Aviation Service Operators (SASO) L&D Aero Services, Rapid Fuel, Advanced AeroTechnologies, VisionAir, Dale Aviation, Fugro Geospatial, Black Hills Life Flight, Great Plains Aircraft Restoration and Rapid Avionics. Details of the existing conditions and future for these activities are included in **Appendix I - General Aviation & Other Uses.**

According to the local Rapid City Air Traffic Control Tower (ATCT) staff, general aviation airport operations are increasing with the majority of growth in turboprop and turbojet corporate aircraft. The airport has a small flight school, which is operated by VisionAir. This Rapid City flight school operates a Cessna 152.

Existing Facilities

An inventory of Rapid City Regional Airport facilities was performed to establish a baseline for determining required future improvements. As discussed in the following sections, airport facilities are grouped into three categories: airside facilities, airspace and navigation aids (NAVAIDs) and landside facilities.

Land

As of the 2014 the Rapid City Airport owns approximately 1,655 acres of property fee simple. In September 2003 the airport was annexed by the City of Rapid City. It was annexed as a non-contiguous area. Even though the action by the City of Rapid City took place in 2003, it was not until a change in state legislation, approved in 2005, that the annexation was officially completed.

Airside Facilities

Airside facilities are those that are necessary for aircraft surface movement, such as runways, taxiways, aprons and associated lighting, marking and signage systems. A map depicting existing airport airside components is included in **Exhibit 2-2: Airside Facilities Map**. Information on design codes is contained in **Appendix H - Airfield Design** and information related to pavement is contained in **Appendix G - Airfield Pavements**.

Runway 14/32

Runway 14/32, the longest runway at Rapid City Regional Airport, is 8,701 feet long and 150 feet wide. The runway is designed to meet FAA Runway Design Code (RDC) C-III design

standards. The runway pavement surface is concrete and grooved to promote drainage. The pavement is designed to accommodate regular use of up to 140,000 pound aircraft in a single wheel main landing gear configuration, 190,000 pound aircraft in a double-wheel main landing gear configuration and 300,000 pound aircraft in a double tandem main landing gear wheel and strut configuration. The runway's Pavement Classification Number is 65 R/C/W/T[2]. A 200 foot long blast pad is located beyond each runway end for jet blast erosion protection. Runway end 32 is designed to accommodate precision instrument approaches.

Runway 5/23

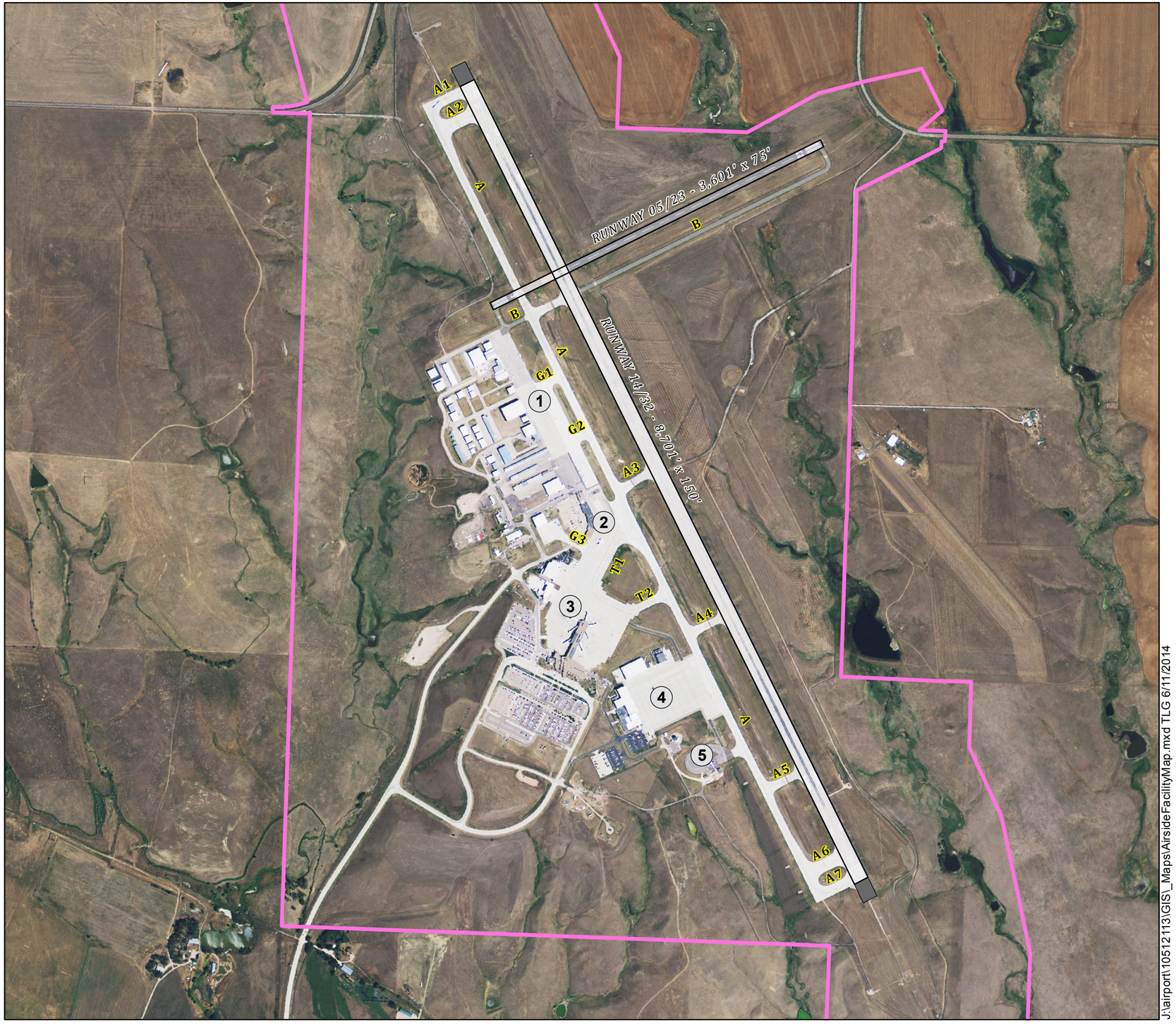
Runway 5/23 is the general aviation runway with dimensions of 3,601 feet long and 75 feet wide. The runway is designed to meet FAA Runway Design Code (RDC) B-I (Small) design standards. The runway pavement surface is asphalt. The pavement is designed to accommodate up to 12,500 pound aircraft in a single wheel configuration. Both runway ends are designed to accommodate non-precision instrument approaches.

Table 2-8 – Runway Facility Summary

Runway Facility Summary		
Component	**Runway 14/32**	**Runway 5/23**
Runway Length (feet)	8,701	3,601
Runway Width (feet)	150	75
Runway Surface Material	Concrete	Asphalt
Runway Surface Treatment	Grooved	
Runway Pavement Strength (lbs.)		
Single Wheel	140,000	12,500
Double Wheel	190,000	-
Double Tandem Wheel	300,000	-
Pavement Classification Number (PCN)	65/R/C/W/T[3]	15/F/C/X/T[4]

R = Rigid Concrete Pavement, F = Flexible Pavement, C = Subgrade Category (Low Strength), W = Unrestricted Tire Pressure, X = Tire Pressure 182 psi to 254 psi, T = Technical Analysis
Source: Airnav.com, FAA Airport Master Record Form 5010 Report, Airport Management records

[2] R = Rigid Pavement, C = Low Subgrade Strength, W = No maximum tire pressure limit, T = Technical Evaluation
[3] The calculations are based on a mixture of aircraft including: MD-83 (500 Annual Departures), CRJ-200 (2,000 Annual Departures), ERJ-145 (2,500 Annual Departures) and A319/A320 (150 Annual Departures)
[4] The calculations are based on a mixture of aircraft including PC-12 (3,500 Annual Departures), Citation VI/VII (24,500 Annual Departures)



Legend

Existing Airport Property

Rapid City Airport Aprons

1. General Aviation
2. Cargo
3. Air Carrier
4. South Dakota Air National Guard (SDARNG)
5. US Forest Service (USFS)

N

0 500 1,000 2,000 Feet

*Intended for Planning Purposes Only

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KLJ

Rapid City Regional Airport
Airside Facility Map
Exhibit 2-2

Taxiways

Rapid City Regional Airport is served by a system of taxiways to facilitate the movement of aircraft from the runway environment to other airport facilities including hangars, parking aprons and hangars. Locations are identified in **Exhibit 2-3**. The parallel taxiway is labeled A to Runway 14/32 and Taxiway B the parallel taxiway to Runway 5/23. Connecting taxiways for Taxiway A are labeled A1 through A7.

Aprons and Taxilanes

There is one commercial service apron and one contiguous general aviation apron at Rapid City Regional Airport. Locations are identified in **Exhibit 2-2**. Apron areas serve the loading, unloading and parking needs for commercial airlines, air cargo, general aviation and military operators.

The air carrier apron serves commercial aircraft around the terminal building located west of Runway 14/32 along Taxiway A. There are two entrance taxiways providing access to all seven gates at the terminal concourse and a total of 9 aircraft parking stand positions. The apron is approximately 40,000 square yards in size with a concrete surface with the pavement strength the same as the runways. Sufficient area is available for ground support vehicles to serve parked aircraft. There is limited parking designated for aircraft de-icing and irregular operations.

The general aviation apron runs along the remainder of Taxiway A and is comprised of approximately 66,000 square yards in size primarily consisting of a concrete surface and a pavement strength the same as the runways.

Pavement Condition

Airport pavements are basic infrastructure components at airports. Airfield pavements should be maintained in a safe and operable condition for aircraft operations. Current Pavement Condition information and further details about the airport's pavement can be found in **Appendix G - Airfield Pavements.**

Navigation Aids & Airspace

Navigational aids (NAVAIDs) provide visual and electronic guidance to pilots enabling the airport to safely, efficiently and effectively accommodate arriving and departing flights. Detailed information about the Rapid City Regional Airport NAVIDS can be found in Appendix K Navigational Aids. Airspace is a resource that is necessary to allow flights to safely operate and maneuver in the airport environment. Detailed information about the Airspace surrounding the Rapid City Regional Airport can be found in **Appendix L - Airspace and Instrument Approaches**.

Airspace and Airspace Obstructions

Rapid City Regional Airport airspace is adjacent to Ellsworth Air Force Base airspace. Ellsworth Air Force Base operates under Class D and Class E airspace. Approach/departure control for Rapid City Regional is operated from Ellsworth Air Force Base which is currently open 24 hours a day. The Rapid City Regional Airport Air Traffic Control Tower is operated as

a contract tower by Midwest Air Traffic Control. The tower operates daily from 6:00 am until 10:00 pm. When approach/departure control is open at Ellsworth Air Force Base and/or the Rapid City Regional tower is open, Class D airspace is in effect at Rapid City Regional. When both facilities are closed, Class E airspace is in effect at Rapid City Regional. Appropriateness of which air traffic facility to contact is determined by which controlling facility is open and whether the aircraft is operating on visual flight rules or if the aircraft is on an instrument flight plan. Detailed Airspace and Airspace Obstruction information is included in **Appendix - L Instrument Procedures and Airspace.**

Surrounding Airports

Public use airports within 30 nautical miles of Rapid City Regional Airport were reviewed to provide background into the other area airports. **Exhibit 2-3 - Surrounding Airports** has been prepared to provide a visual indication of these airports.

Table 2-9 – Surrounding Airports

Surrounding Airports					
Airport Name	**FAA ID**	**Location from RAP**	**Based Aircraft**	**Instrument Approach**	**Longest Runway Dimensions**
Rapid City Airport	***RAP***	**-**	***109***	**Yes/ILS**	***8,701' x 150'***
Ellsworth AFB*	RCA	5 m N	na	Yes/ILS	13,497' x 300'
Sturgis Municipal	49B	40 m NE	25	Yes/GPS	5,100' x 75'
Custer County	CUT	50 m SE	14	No	5,513' x 60'
Custer State Park	3V0	45 m SE	0	No	4,000' x 50'
Black Hills Airport	SPF	57 m NE	72	Yes/GPS	6,401' x 75'
Wall Municipal	6V4	55 m E	13	No	3,500' x 60'

*Source: FAA Airport Master Record Form 5010 Report. Note: m = miles; * not for Public Use*

Additional information regarding the FAA's classification system, the South Dakota State Aviation System Plan and airport in the region can be found in **Appendix D - Airport Classification.**

(SPF)
Black Hills Airport

(49B)
Sturgis Airport

(RCA)
Ellsworth Air Force Base

(RAP)
Rapid City Regional Airport

(6V4)
Wall Municipal Airport

5 Nautical Miles

10 Nautical Miles

20 Nautical Miles

(CUT)
Custer County Airport

(3V0)
Custer State Park Airport

(HSR)
Hot Springs Municipal Airport

(6V0)
Edgemont Municipal Airport

Legend

- NearbyAirports

Rapid City Regional Airport (RAP)
-111 Based Aircraft
- 8,701 - foot Primary Runway, Runway 32 ILS
- Commercial Service Airport

Ellsworth Air Force Base (RCA)
- 13497-foot Primary Runway, ILS Approaches
- Military Airport

N

0 5 10 20 Miles

*Intended for Planning Purposes Only

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Rapid City Regional Airport
Surrounding Airports Map
Exhibit 2-3

Landside Facilities

Landside facilities consist of areas of the Rapid City Regional Airport necessary for the movement of passengers and automobiles, and parking and storage of aircraft. Examples of these facilities include the passenger terminal building, public parking lots, access roads, hangars and airport support facilities. A map depicting components of the landside facilities is shown on **Exhibit 2-4 - Landside Facilities Map**. The details of the different landside areas are included in several different appendices. These are:

- **Appendix I - General Aviation & Other Uses** – includes general aviation, military, air cargo and other uses.
- **Appendix J - Support Facilities** – includes Aircraft Rescue and Firefighting, Maintenance, Snow Removal, Fueling Facilities and similar items
- **Appendix T - Terminal Facilities** – includes airline terminal, public parking, rental car and similar uses

Passenger Terminal Complex

The passenger terminal complex is located on the west side of the airport and is accessed from South Dakota Highway 44 by Airport Road and Terminal Road. It is located west of Runway 14/32 along the middle portion of this primary runway.

Terminal Building

The terminal building serves multiple functions including general circulation, ticketing, passenger security screening, baggage screening, baggage claim, airport administration, concessions and restrooms. The terminal serves airlines and their regional affiliates; Allegiant Air, American Airlines, Delta Air Lines, and United Airlines.

The passenger terminal consists of a terminal building and one concourse that is approximately 90,000 square feet in size with two levels plus an additional 12,600 square feet in a basement and penthouse area, not accessible to the public. There are currently seven aircraft gates each with a passenger loading bridge. The details of the Terminal Building are included in **Appendix T - Terminal Facilities.**

1. Private Hangar
2. SASO Hangar
3. SASO Office
4. SASO Hangar
5. SASO Hangar
6. Private Hangar
7. FBO Hangar
8. FBO Hangar
9. SASO Hangar
10. SASO Office
11. Private Hangar
12. Private Hangar
13. T-Hangar (SASO)
14. Airport Maintenance Shop
15. T-Hangar (FBO)
16. T-Hangar (Condo)
17. T-Hangar (FBO)
18. T-Hangar (FBO)
19. FBO Hangar and Terminal
20. SASO Hangar
21. SASO Hangar
22. Private Hangar
23. Private Hangar
24. Airport Maintenance Shop
25. Airport Cold Storage Bld.
26. Airport Sand Storage Bld.
27. Private Hangar
28. Private Hangar
29. Private Hangar
30. Private Hangar

31. SASO Hangar
32. Private Hangar
33. Private Hangar
34. Private Hangar
35. Private Hangar
36. T-Hangar (Private)
37. T-Hangar (Private)
38. T-Hangar (Private)
39. T-Hangar (Condo)
40. Vacant
41. Vacant
42. Vacant
43. TSA, Civil Air Patrol
44. SASO Hangar
45. 'Old' Terminal
46. 'Old' Fire Station
48. Aviation Fuel
49. Fuel Farm
50. Air Tanker Base
51. Air Traffic Control
52. National Guard
53. National Guard
54. National Guard
55. Private Hangar
56. T-Hangar (Condo)
59. SASO Hangar
60. Electrical Vault
62. Fire Department
70. Car Rental QTA

N

0 250 500 1,000 Feet

*Intended for Planning Purposes Only

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Rapid City Regional Airport
Landside Facilities Map
Exhibit 2-4

Aircraft Storage

Rapid City Regional Airport has 111 reported civil aircraft based at the airport. Aircraft storage facilities consists of large conventional hangars (greater than 8,000 square feet), small conventional hangars (8,000 square feet or less), and T-hangars. The primary aircraft storage area is north of the terminal area. Aircraft storage facilities are detailed in **Appendix I – General Aviation & Other Uses**.

Fuel Facilities

Rapid City Regional Airport has a dedicated fuel farm that accommodates aircraft and automobile fuel. The existing fuel tanks occupy approximately 1,700 square yards of the fuel farm's 7,800 square yards. Aircraft fuel tanks include 100 low lead (100LL) and Jet A fuel tanks owned by the FBO, WestJet. Automobile fuel includes unleaded and diesel fuel tanks owned by the Airport. Further details regarding the fueling capabilities at the airport are found in **Appendix J – Support Facilities**.

Airport Rescue & Fire Fighting

The ARFF facility at Rapid City Regional Airport is located on the terminal apron immediately north of the airline passenger terminal.

The FAR Part 139 index determination for an airport is calculated based on the largest air carrier aircraft in passenger service that conducts an average of five or more daily operations. The Rapid City Regional Airport ARFF facility is required to maintain vehicles, chemicals, and response items in accordance with FAR 139 Index Group B. A complete vehicles inventory list and details about the airport's ARFF capabilities is included in **Appendix J – Support Facilities.**

Airport Maintenance

Rapid City Regional Airport's maintenance facilities are located in the general aviation area and consist of four buildings. There is a total of 22,400 square feet of space including equipment storage, maintenance, offices and materials storage. The airport staff conducts all maintenance at the airport including airfield, buildings, snow and ice control and custodial. A list of the airport's snow and ice control equipment is included in **Table 2-10 Snow and Ice Control Equipment**. Further details about the airport's maintenance buildings and equipment can be found in **Appendix J – Support Facilities**.

Table 2-10 – Snow and Ice Control Equipment

Make/Model	Unit No.	Plow Size (feet)	Broom Size (feet)	Rotary Plow (tons/hour)	Year
Runway/Taxiway Plows					
Oshkosh 4x4 w/Sand Spreader and Liquid Deicer	5	14	-	-	1996
Oshkosh 4x4 w/Sand Spreader, Under Body Scraper and Liquid Deicer	19	24	-	-	2001
Mack 4x4	21	18	-	-	1984
Oshkosh 4x4	41	17	-	-	1996
Apron Plows					
Michigan Loader	12	20	-	-	2001
Dresser Motor Grader	16	12	-	-	1992
Brooms/Blowers/Other					
Oshkosh 4x4	20	-	20	-	1996
Flush Truck – Liquid Deicer	22	-	-	-	2008
Oshkosh Snow Blaster 4x4	6	-	-	5000	2010
Oshkosh 4x4	15	-	20	-	2001

Source: (Rapid City Regional Airport Snow and Ice Control Plan) 10/31/2013

Ground Access, Parking & Circulation

Access is addressed in three different areas. These include access to and from the airport, access on publicly available roads on the airport, and access inside the airfield fence for maintenance and operations at the airport. Each of these areas are addressed with information and diagrams in A**ppendix J – Support Facilities.**

Land Use Compatibility

Compatible land uses are defined as those uses that can coexist with a nearby airport without either constraining the safe and efficient operation of the airport or exposing people working or living nearby to unacceptable levels of noise or safety hazards. Incompatible land use is a large issue facing airports today, often resulting in conflicts between airports and communities. Typical airport land use compatibility elements include:

- FAA land use compatibility within designated day-night average sound level (DNL) noise exposure contours to avoid significant impacts to activities on the ground.
- FAA airspace standards for airport safety and operational capability.
- FAA land use compatibility near runway ends associated with the Runway Protection Zone (RPZ) for the safety of people and property on the ground.
- State or local airport land use standards, if applicable.
- FAA wildlife hazard mitigation plans for aircraft operational safety.

Airports have a responsibility to constantly work together with local governments to identify, control and prevent the creation of potential incompatibilities. This section is an introduction to this topic; a more comprehensive evaluation in relation to existing and planned airport development is prepared in **Appendix O - Land Use Compatibility**.

Existing Land Uses

The existing land uses within the airport environs is depicted on a map in **Exhibit 2-1.** Rapid City Regional Airport is primarily surrounded by agricultural and rural residential uses. There are no incompatible land uses near the airport with the exception that land to the northeast of the airport currently attracts waterfowl. These waterfowl move regularly east to west from food sources to habitat and cross the airport in the process.

Adjacent Private Airport

One unique land use on the east side of the airport is a private use airport, Dan's Airfield (FAA Identifier 4SD4). The proximity of the airport does require the ATCT to coordinate any activity from this airport with activity at Rapid City Regional Airport. This coordination and future recommendations are addressed in Chapter 4, page 4-10 related to Runway Use.

Airport Zoning

City of Rapid City

The City of Rapid City added Chapter 17.58 - Airport Zoning District to the Rapid City Municipal Code (RCMC) effective November 11, 2005. The Chapter establishes zoning authority over the Airport Zoning District, which encompasses the airport property. In Chapter 17.58, an Airport Encroachment Area and Height Regulations section are established in reference to Part 77, but do not adequately define the restrictions. In addition, the terminology used in RCMC Chapter 17.58 and Part 77 do not exactly match. The zones and height restrictions referred to in RCMC Chapter 17.58 are defined by the imaginary surfaces in Part 77, as shown in the comparison below.

Comparison	
Rapid City Municipal Code Chapter 17.58	**14 CFR Part 77.25**
Runway Area Zones	Primary Surface
Approach Departure Zones	Approach Surface
Transition Zones	Transitional Surface
Horizontal Zone	Horizontal Surface
Conical Zone	Conical Surface

Pennington County

Pennington County has zoning authority over the area surrounding and abutting the Airport property. Airspace protection is provided for Rapid City Regional Airport in Section 301 of the Pennington County Zoning Ordinance. Section 301 establishes zones and height limitations consistent with FAR Part 77.19; exempts existing non-conforming uses; establishes a variance approval process; and allows appeals to the Board of Adjustment, followed by judicial review.

There are four areas of concern with the existing language of Pennington County Zoning Ordinance Section 301 as follows:

1. Subsection D.10 states:

   "Nothing in this Ordinance shall be construed as prohibiting the construction or maintenance of any structure, or growth of any tree, to a height up to fifty (50) feet above the surface of the land."

Due to local topography, especially north of Rapid City Regional Airport, it is possible that a structure less than 50 feet tall could present a hazard to air navigation to the airport users. Also, this subsection appears to contradict the language in subsection G.1.

2. Although Section 301 requires a County Permit for uses in the defined zones (except structures and trees less than 50 feet high that wouldn't extend above zone height limits), it does not mention the federal requirement to file FAA Form 7460-1 before construction, if the construction meets certain criteria outlined in Part 77[5]. Procedurally, the County may require an applicant to file FAA Form 7460-1 and receive a response from the FAA before the County issues a permit, but including that requirement in the Ordinance would strengthen the County's position and avoid applicant consternation and misunderstanding of the process.

3. Subsection C refers to a Rapid City Airport Zoning Map consisting of two sheets dated October 15, 2003. That map should be updated to incorporate the Part 77 surfaces detailed in the most recent ALP. The Part 77 surface maps which will be updated as a part of this Airport Master Plan could be utilized for that purpose.

4. Subsection D.7 and D.8 incorrectly apply an airport elevation of 100 feet above mean sea level. This should be 3,204 feet above mean sea level.

City of Box Elder

The City of Box Elder has recently adopted zoning specific to Ellsworth Air Force Base with some portions referencing Rapid City Regional Airport. Section seven of the city's planning and zoning regulations provides airspace and land use restrictions.

[5] *Persons failing to comply with the provisions of Part 77 are subject to Civil Penalty under Section 902 of the Federal Aviation Act of 1958, as amended and pursuant to 49 U.S.C. Section 46301(a). Examples of times when a structure proponent is required to file Notice of Construction (Form 7460-1)*

- *Structures Exceeding 200 feet above ground level*
- *Structures Within 20,000 feet of public/military airport, that exceed 100:1 surface from any point on the runway*
- *Everything located on an airport*

Environmental Overview

The purpose of this section is to provide a general overview of environmental features which should be considered in the alternatives analysis. The intent is not to perform detailed analysis, but rather to assemble readily available information in a systematic manner. A review of National Environmental Policy Act (NEPA) criteria relative to development alternatives considered and the NEPA approval process is discussed in **Chapter 7 - Environmental Review**.

Conclusion

The information collected and documented in this Existing Conditions chapter provides a baseline foundation to update the Rapid City Regional Airport long range plan. This information will feed into future sections including developing aviation activity forecasts and determining how facilities will meet the projected airport needs.

Chapter 3: Aviation Forecasts

Introduction

The Aviation Forecasts chapter of the Airport Master Plan analyzes current and future airport activity at the Rapid City Regional Airport (RAP). Forecasting provides an airport with a general idea of the magnitude of growth, as well as fluctuations in activity anticipated over a 20-year forecast period. They assist the Airport in determining existing and planned future facility needs based on airport activity level estimates and projections. Forecasts attempt to develop a realistic estimate of future changes. When conditions dramatically change, forecasts should be reviewed and updated.

The forecasts developed for the Airport will be important to adequately plan, size, and sequence development of future facilities to meet future projected growth. Development at airports, however, is demand-based from actual numbers rather than forecasts.

To thoroughly analyze and develop a probable aviation forecast, a technical review has been completed using several methods to help quantify the potential aviation activity over the next 20 years.

Forecast Rationale

Forecasting the demand for airport services is a critical step in the development of an airport. It allows an airport to examine its ability to satisfy the needs of the aircraft and people it serves, and to determine the approximate timing of necessary improvements by projecting airport user activity levels.

Forecasts developed for airport master plans and/or federal grants must be approved by the Federal Aviation Administration (FAA). It is the FAA's policy, listed in Advisory Circular 150/5070-6B, *Airport Master Plans*, that FAA approval of forecasts at non-hub airports with commercial service should be consistent with the Terminal Area Forecasts (TAF). Master plan forecasts for operations, based aircraft and enplanements are considered to be consistent with the TAF if they meet the following criteria:

1. Forecasts differ by less than 10 percent in the five-year forecast and 15 percent in the 10-year or 20-year period, or
2. Forecasts do not affect the timing or scale of an airport project, or
3. Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3, *Field Formulation of the National Plan of Integrated Airport Systems*.

The TAF model used for this report is from the 2013 FAA TAF available in January 2014. This is latest data available when the forecasting effort began for this airport master plan.

Furthermore, in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, states forecasts should be:

1. Realistic
2. Based on the latest available data
3. Reflect the current conditions at the airport
4. Supported by information in the study
5. Provide an adequate justification for the airport planning and development

Factors Affecting Forecasts

FAA provides general guidance in evaluating factors that affect aviation activity. FAA AC 150-5070-6B, *Airport Master Plans*, states:

> *Planners preparing forecasts of demand or updating existing forecasts should consider socioeconomic data, demographics, disposable income, geographic attributes, and external factors such as fuel costs and local attitudes towards aviation.*

For purposes of this forecast, the following defining factors have been used to develop the forecast:

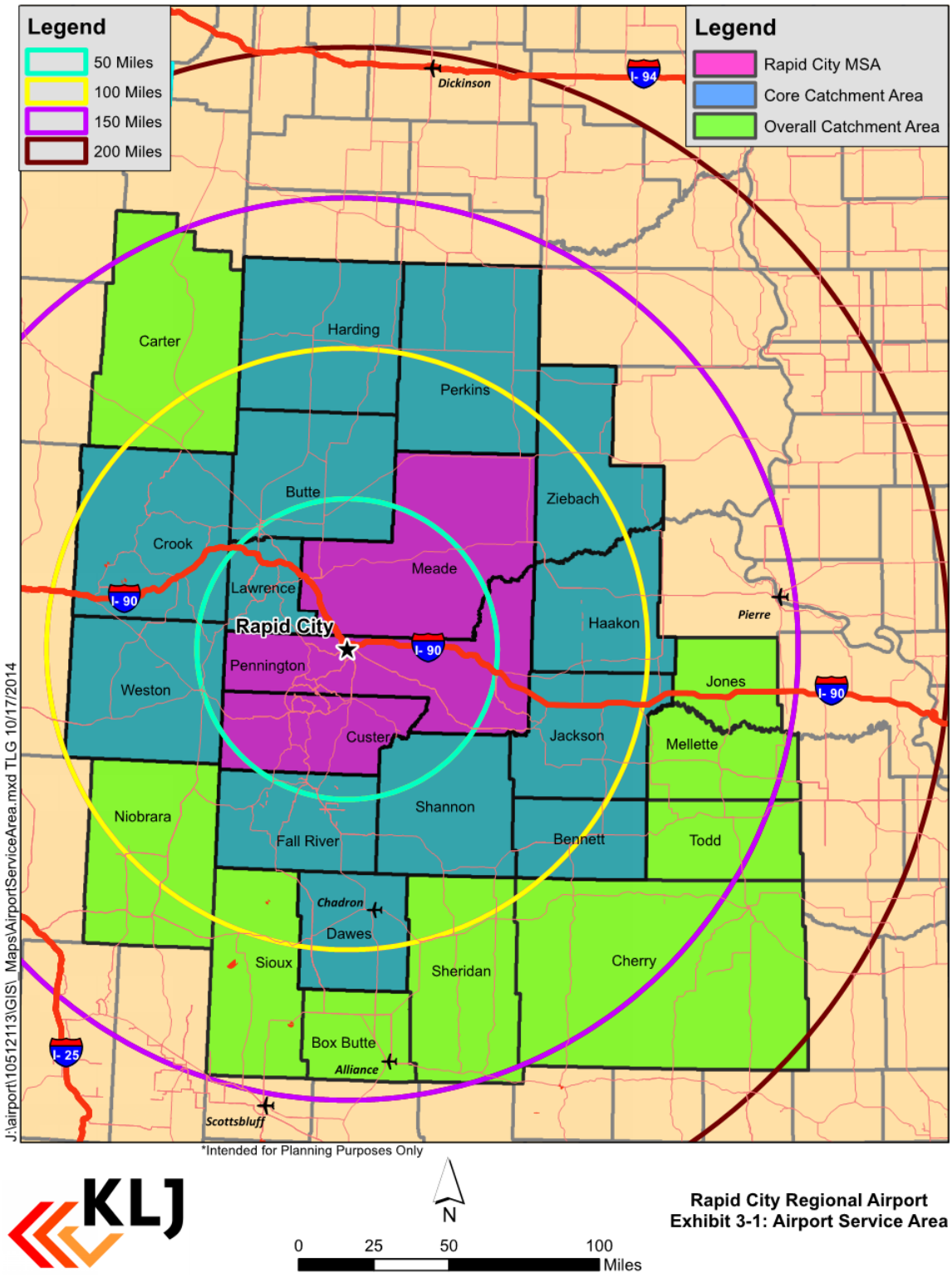
1. Fiscal year 2013 has been used as the base year for most of the aviation forecast projections.
2. The most recent 2013 estimates and future projections of population, employment and income trends have been utilized.
3. The "core" catchment area for RAP has been developed using data from the Rapid City Metropolitan Statistical Area (MSA). This includes the following counties: Pennington, Meade and Custer County.

The broader RAP catchment area covers a 58 county area over eastern South Dakota, southwestern Minnesota and northwest Iowa as defined by previous air service studies. The Rapid City MSA was used because 76 percent of commercial passenger trips, as well as other commercial and general aviation activity are generated from within the Rapid City MSA.

The forecasts prepared for the airport assume an unconstrained scenario where facilities are available for use to meet demand. Any constrained forecasts prepared will be noted throughout the document. Time periods include short-term (5-year), mid-term (10-year) and long-term (20-year) resulting in forecasts for year 2018, 2023 and 2033. Forecasts may be developed using a composite of methodologies over the planning period.

Because aviation activity fluctuates due to unforeseen changes to demand and the industry, the forecasts developed in this section will be developed into Planning Activity Levels (PALs) in future chapters to identify activity demand triggers for future facility improvements.

Exhibit 3-1 – Airport Service Area



Commercial Aviation Forecasts

Commercial aviation consists of civil aviation that involves operating an aircraft for hire to transport passengers or cargo. The forecast elements evaluated in this report applicable to RAP include:

- Passenger Airline Forecasts
- Air Cargo Forecasts
- Other Commercial Forecasts

Passenger Airline Forecasts

Passenger airline forecasts include passenger enplanements and operations. Passenger airline enplanements at an airport represent the number of revenue passengers boarding commercial service aircraft that depart an airport. An operation is a takeoff or a landing of an aircraft conducting a passenger carrying operation on a scheduled or unscheduled basis. As defined by FAA, passengers are carried in air carrier aircraft (scheduled service in more than 60 seat aircraft), air taxi aircraft (scheduled service of four or fewer flights per week or on-demand service, in 60 or fewer seat aircraft) or commuter "regional" aircraft (scheduled service of five or more round-trip flights per week on a route in 60 or fewer seat aircraft).

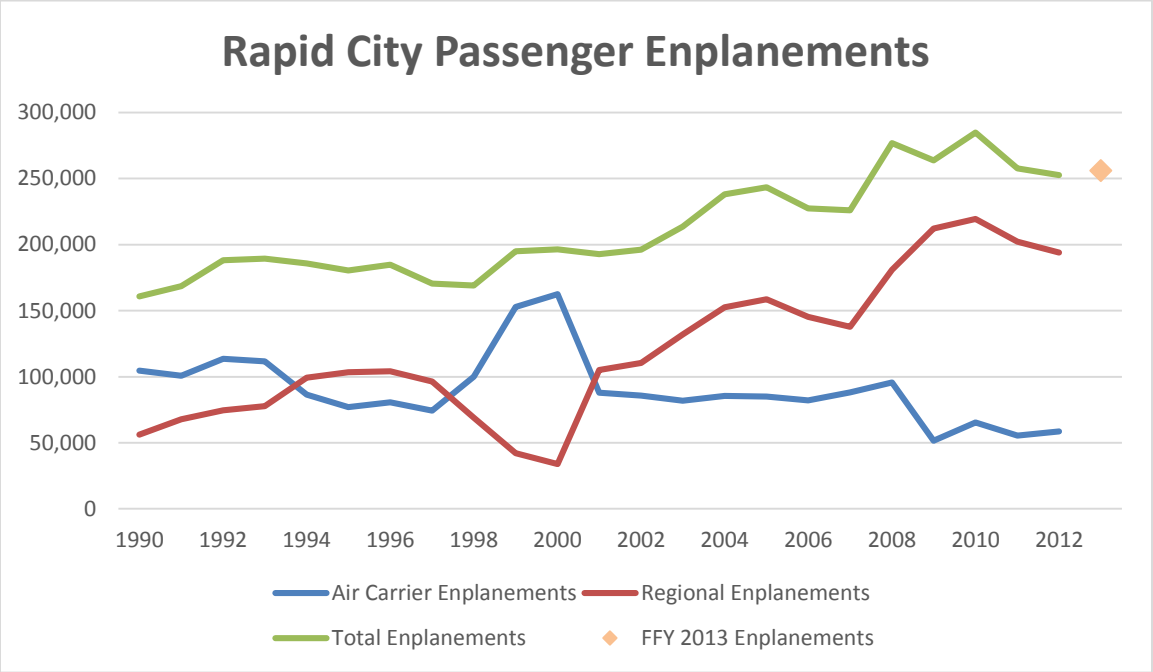
Airport Trends

Enplanements

On average since 1990, passenger enplanements at Rapid City have been increasing, but there have been fluctuations which are likely attributed to economic slowdown in the early 2000's and most recently during the recession of 2009. Population and employment since 2000 has increased at a steady rate.

Historically the passenger enplanements at RAP have been carried by regional type aircraft. Since the advent of widespread use of regional jets, RAP has seen the majority of passenger enplanements carried by regional airlines in these aircraft types.

Figure 3-1 – Passenger Enplanements



*Source: FAA Terminal Area Forecast (January 2013), RAP Monthly Passenger Records, Bureau of Transportation Statistics (BTS) T-100 Segment (All Carriers) *2013 Data through August 2013*

Table 3-1 – Passenger Enplanements

Passenger Enplanements Table			
Year	**Air Carrier**	**Air Taxi/Commuter**	**TOTAL**
1990	104,547	56,220	160,767
1995	77,081	103,376	185,457
2000	162,544	33,787	196,331
2005	84,869	158,617	243,486
2010	65,455	219,502	284,957
2012	58,625	193,983	252,608
Historical CAGR	*-2.60%*	*5.79%*	*2.08*

Source: FAA Terminal Area Forecast

In addition to the economic recovery, the level of passenger airline service at Rapid City has grown in the last few years to contribute to the enplanement growth. New service includes additional service to seasonal destinations and frequency through Allegiant Airlines, twice-daily service to Dallas/Fort Worth on American Airlines, seasonal service to Atlanta on Delta Airlines, seasonal service to Chicago on American Airlines and seasonal service to Houston on United. As of July 2014, the airport now provides 147 weekly departures to eight non-stop destinations on four airlines and related regional partners.

Rapid City's location has allowed it to typically capture most of the travel within its catchment area with the only significant leakage to Denver which is more than a 6 hour drive. As mentioned above the fluctuation in enplanements is primarily from changes in the national economy which impacts the tourism element. While tourism will remain a major part of the Rapid City's economy, the area is diversifying, which will only help if another national economic downturn occurs.

Operations

Overall commercial operations are tracked by FAA for all scheduled and unscheduled passenger and air cargo flights. A departure is a flight leaving the airport for another destination.

The number of scheduled passenger departures were reviewed since 1990. Scheduled departures have increased at a slower rate of 1.29 percent annually as compared to passenger enplanements. This has to do with the use of larger regional aircraft over the past several years; this trend is anticipated to continue as the 50 seat regional aircraft are replaced by 70-90 seat aircraft.

The most current December 2013 and July 2014 flight schedules were reviewed to determine the current scheduled passenger service fleet mix. The compiled schedules indicate a significant use in 50-seat regional jet aircraft with 72 percent of departures, followed by 4 percent of departures each in 61 to 90-seat, 22 percent in 121 to 150-seat aircraft types, and less than 1 percent of departures in 151 seat or greater aircraft

Non-Stop Destinations from Sioux Falls[1]	Weekly Flights[2]
o Las Vegas, NV - LAS	2 (G4)
o Denver, CO - DEN	42 (AA)
o Phoenix/Mesa, AZ - AZA	3 (G4)
o Dallas/Ft. Worth, TX - DFW	21 (DL)
o Atlanta, GA (seasonal) - ATL	7 (DL)
o Chicago, IL (seasonal) - ORD	7 (AA), 21 (UA)
o Minneapolis/St. Paul, MN - MSP	35 (DA)
o Huston, TX (seasonal) - IAH	7 (UA)

[1]**Source:** Rapid City Regional Airport Flight Schedules

[2]**Air Carriers:**
G4 = Allegiant Airlines
DL = Delta Airlines
UA = United Airlines
AA = American Airlines

N

0 125 250 500 Miles

*Intended for Planning Purposes Only

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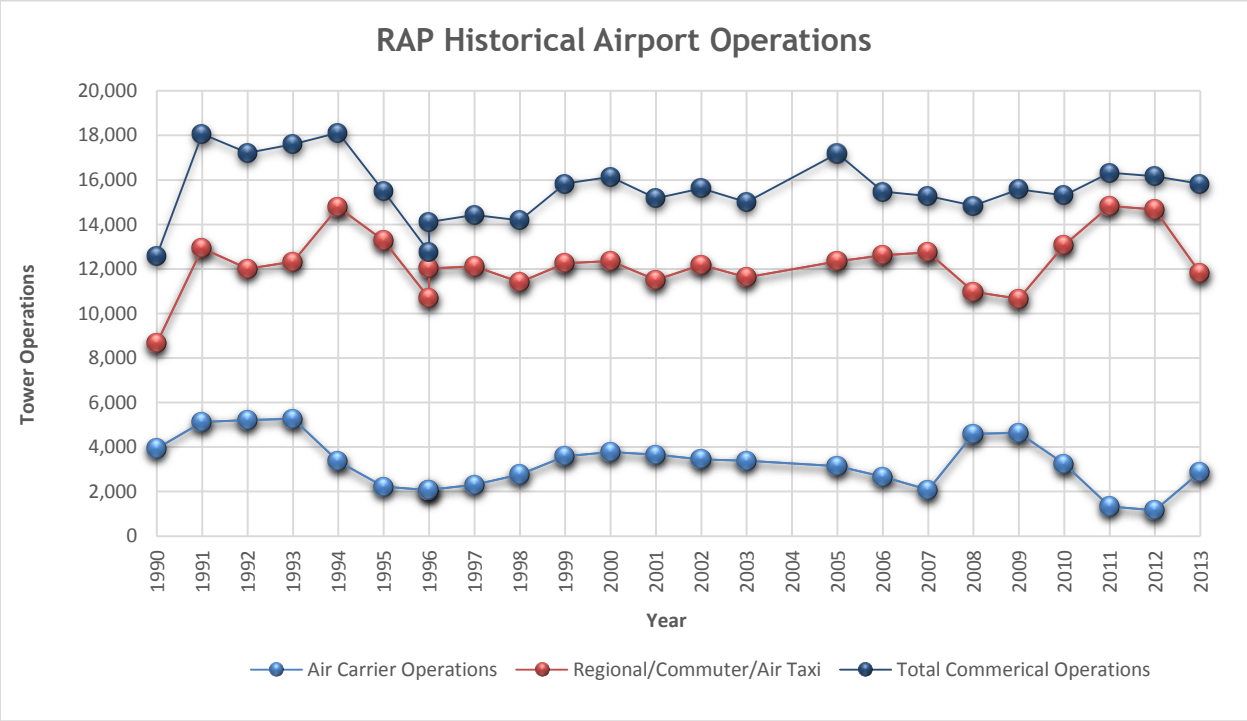
Rapid City Regional Airport
Exhibit 3-2: Passenger Air Service

Figure 3-2 – Commercial Operations



Source: FAA Terminal Area Forecast

The number of air carrier and commuter passenger airline departures were also reviewed since 1990. Air carrier departures have increased at a slower rate of decreased 1.35 percent annually from 1990 to 2012 as compared to air taxi commuter operations which have increased by roughly the same amount (1.36 percent) over the same period. In 2012, 81 percent of the passenger-carrying departures performed were in aircraft operated by regional carriers.

Table 3-2 – Commercial Departures

Passenger Departures Table			
Year	**Air Carrier**	**Air Taxi/Commuter**	**TOTAL**
1990	2,935	8,664	12,599
1995	2,218	13,275	15,493
2000	3,583	12,251	16,143
2005	3,144	12,336	15,480
2010	3,245	13,077	16,322
2012	2,878	11,808	15,828
Historical CAGR	*-1,35%*	*1.36%*	*1.04%*

Source: Airport Traffic Air Activity System, 2013

Scheduled departure data was further analyzed for operational trends over the past five years. Departures in regional aircraft less than 40 seats are virtually nil as a result of regional airlines turboprop aircraft phasing out smaller turboprop aircraft. Departures in the 40 to 60-seat regional jet are the highest category at RAP with peaks achieved in 2010. For air carrier

aircraft, the 61 to 90-seat aircraft types are increasing in use along with the introduction of new 91 to 99-seat aircraft types. Departures in 121 to 150-seat aircraft have dramatically decreased over the past five years, however operations in 151-seat and greater aircraft have slightly increased in use.

Table 3-3 – Passenger Aircraft Fleet Mix

Passenger Aircraft Fleet Mix & Operations					
Seating Capacity	**2008**	**2009**	**2010**	**2011**	**2012**
Air Taxi/Commuter					
40-60 Seats	69.07%	77.03%	86.29%	90.73%	88.87%
Air Carrier					
61-99 Seats	8.06%	9.46%	.056%	0.21%	1.55%
100-120 Seats	7.34%	0.18%	4.55%	2.21%	3.04%
121-150 Seats	15.25%	13.05%	8.41%	6.29%	6.31%
151+ Seats	0.28%	0.27%	0.20%	0.56%	.023%

Source: Bureau of Transportation Statistics (BTS) T-100 Segment (All Carriers), KLJ Analysis
Note: Regional is 60 seats or less, Air Carrier is greater than 60 seats

Airlines have increased using the 40-60 seat aircraft to help maintain frequency and preserve load factors which have hovered around 75 percent over the past ten years.

Proposed Forecast

A new Master Plan forecast of enplaned passengers and related metrics has been prepared using available data several methodologies and professional judgment based on experience. The forecasts prepared are unconstrained and represent forecast demand.

Assumptions made for this Master Plan forecast include:

- The local Rapid City economy will remain strong and resilient. Population, employment and income growth will generally follow projections.
- Rapid City Regional Airport will continue air service development efforts.
- There will be no reduction to the current 2013 flight schedule. Air service recently started to new destinations will remain through the long-term.
- Enplanement demand will be met by the airlines through adding flight frequency, aircraft capacity and airline destinations to meet the need at existing hub airports.
    - Potential new service is explored in separate air service studies rather than this master plan.
- No considerations were made for airline mergers.
- The 50-seat regional jet aircraft type will begin to be phased out because it is less profitable than larger regional aircraft. There will be a significant reduction in usage of ERJ-135/145 and CRJ-200 aircraft for short-haul routes in the near term and be replaced by larger 70-100 seat regional jets such as the CRJ-700/900 series aircraft, Embraer E-series jets, and new Mitsubishi MRJ90 aircraft on order to SkyWest Airlines. The 50-seat Embraer ERJ-145 aircraft will still continue to be used by other regional carriers such as ExpressJet.

- Routes currently served by regional jets for Delta Air Lines will see replacement with larger 110 seat Boeing 717 aircraft in the mid-term.

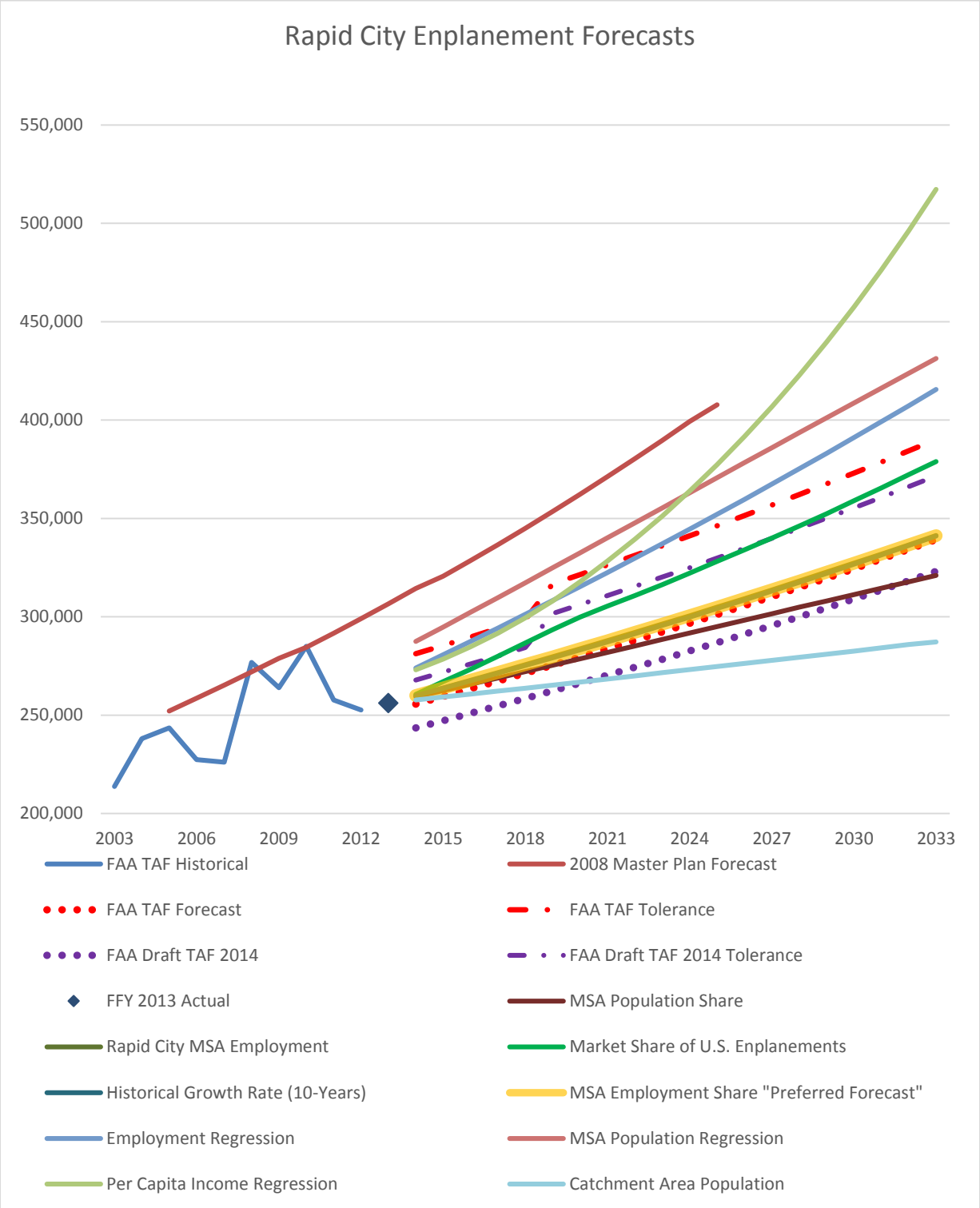
Airports Cooperative Research Program (ACRP) Synthesis 2: *Airport Aviation Activity Forecasting* demonstrates changes in the commercial airline industry have occurred in the last 25 years but have not been reflected in FAA definitions for air carrier, air taxi and commuter operations. The study notes the distinction between scheduled and unscheduled service to be most relevant. To be consistent with the industry trend of regional carriers operating larger aircraft for facility planning, a revised definition for air carriers as aircraft with 100 seats or more and regional/commuter/air taxi aircraft with less than 100 seats was proposed. This would more accurately separate traditional air carrier and regional airlines. However the traditional 60 seat definition is used for this forecast to be consistent with current FAA forecast approval guidelines.

Selected Forecast

Various forecast methods and professional experience were used to develop a preferred forecast, which is based on the MSA Employment Share.

The preferred forecast yields 341,298 forecast total enplanements in year 2033 for an average annual growth rate of 1.44 percent. The enplanements are split into an estimated 79,208 for passenger air carriers (23.21 percent of total) and 262,090 for regional airlines (76.79 percent of total) based the projected aircraft fleet mix. *The preferred forecast is consistent with the TAF and tracks well with historic population and growth trends*.

Figure 3-3 – Passenger Enplanements Forecast Methods



Source: KLJ Analysis, FAA Terminal Area Forecast (January 2013), Rapid City Regional Airport, 2008 Airport Master Plan, City of Rapid City Planning Department (2012), FAA Aerospace Forecasts (2013-2033), Woods & Poole Economics

Table 3-4 – Preferred Forecast Enplanements

Forecast Enplanements				
Enplanements	**2013**[1]	**2018**	**2023**	**2033**
Air Carrier	59,457	63,969	68,754	79,208
Regional	196,734	211,665	227,499	262,090
TOTAL	**256,191**	**275,634**	**296,254**	**341,298**

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

Table 3-5 – Preferred Forecast Enplanements by Type

Preferred Forecast Enplanements by Type					
Metric	**2013**	**2018**	**2023**	**2033**	**CAGR**
Air Carrier (>60 seats)					
Total Enplanements	220,835	398,117	483,555	602,182	*5.14%*
Air Taxi/Commuter (≤60 seats)					
Total Enplanements	253,283	149,822	121,317	154,639	*2.27%*

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

Airline Fleet Mix

The type of passenger service aircraft that utilize the airport defines the operations needed to serve the forecast enplanements. Flight schedules from December 2013 and July 2014 were reviewed to develop an annual schedule and current aircraft fleet mix. Projected fleet mix is developed based on known industry trends. The phase-out of the 50-seat regional jet is significant to the overall fleet mix at Rapid City as 72 percent of the current flights are in this type of aircraft.

Table 3-6 – Passenger Aircraft Fleet Mix

Passenger Aircraft Fleet Mix				
Seating Capacity	**2013**	**2018**	**2023**	**2033**
Less Than 40 Seats	0%	0%	0%	0%
40-60 Seats	72%	70%	64%	60%
61-99 Seats	4%	7%	8%	11%
100-120 Seats	0%	1%	5%	4%
121-150 Seats	22%	20%	19%	21%
150+ Seats	.5%	0%	2%	2%
TOTAL	**100%**	**100%**	**100%**	**100%**

Source: Rapid City Regional Airport, KLJ Analysis
Note: Due to rounding numbers do not equal 100 percent

The projected fleet mix is combined with the enplanement forecasts to determine flight metrics including average seats per departure and enplanements per departure. Passengers per regional airline departure is forecast to increase to accommodate the loss of the 50-seat

[1] *Fiscal Year 2013 Enplanements are based on monthly airport passenger reports. Air carrier and regional enplanements are estimated based on fleet mix metrics.*

regional jet and air carrier passengers per departure will decrease as lower capacity air carrier aircraft are used and some flights are transferred to larger regional aircraft.

The current load factor of 74.9 percent was determined from the latest year's average from the Bureau of Transportation Statistics for Rapid City. The load factor is projected to stay at roughly 75 percent throughout the planning period. While national averages are anticipated to stay in the low 80's, RAP has shown the ability to maintain (and attract) service because of the relative distance of other commercial service airports and the proximity of tourism related activity. As mentioned previously the Rapid City economy is diversifying, which will only help maintain and attract airline service.

Table 3-7 – Passenger Data Per Departure

Passenger Data Per Departure				
Metric	**2013**	**2018**	**2023**	**2033**
Air Carrier (100+ seats)				
Average Seats Per Departure	120.6	119.0	120.1	120.1
Average Load Factor	74.45%	74.00%	74.00%	74.00%
Enplanements Per Departure	89.8	88.1	88.9	88.8
Regional (<100 seats)				
Average Seats Per Departure	42.7	46.5	46.9	52.4
Average Load Factor	76.15%	75.00%	75.00%	75.00%
Enplanements Per Departure	32.5	34.9	35.1	39.3
Total				
Average Seats Per Departure	50.2	53.7	56.1	62.2
Average Load Factor	74.88%	75.00%	75.00%	75.00%
Enplanements Per Departure	61.2	61.5	62.0	64.1

Source: KLJ Analysis

Airline Operations

Passenger airline operations are determined from the average enplanements per departure from the fleet mix determinations. An operation is a considered an aircraft departure or an arrival.

Overall operations will remain steady or decrease slightly in the short-term as overall seats per departure increase. Regional operations will decrease as larger aircraft and/or reduced frequency are used to accommodate demand on routes to replace the 50-seat regional jet. Air carrier operations will increase in the short-term to accommodate additional flights then stabilize as flights in regional aircraft begin to increase again with new 61-99 seat aircraft types are introduced.

Table 3-8 – Passenger Airline Operations

Passenger Airline Operations				
Metric	**2013**	**2018**	**2023**	**2033**
Departures				
Air Carrier	1,074	688	910	1,094
Regional	5,934	6,162	6,129	6,218
Operations				
Air Carrier	2,148	1,376	1,821	2,187
Regional	11,868	12,323	12,258	12,435
TOTAL	**14,016**	**13,700**	**14,079**	**14,623**

Source: KLJ Analysis

Summary

A summary of the preferred passenger aviation forecasts are provided in the table below:

Table 3-9 – Preferred Passenger Airline Forecasts Summary

Preferred Passenger Airline Forecasts Summary				
Metric	**2013**	**2018**	**2023**	**2033**
Air Carrier	59,457	63,969	68,754	79,208
Air Taxi/Commuter	196,734	211,665	227,499	262,090
TOTAL	**256,191**	**275,634**	**296,254**	**341,298**
Avg. Seats/Departure	61.2	61.5	62.0	64.1
Avg. Load Factor	74.88%	75.00%	75.00%	75.00%
Air Carrier	2,148	1,376	1,821	2,187
Commuter	11,868	12,323	12,258	12,435
TOTAL	**14,016**	**13,700**	**14,079**	**14,623**

Source: KLJ Analysis

Air Cargo

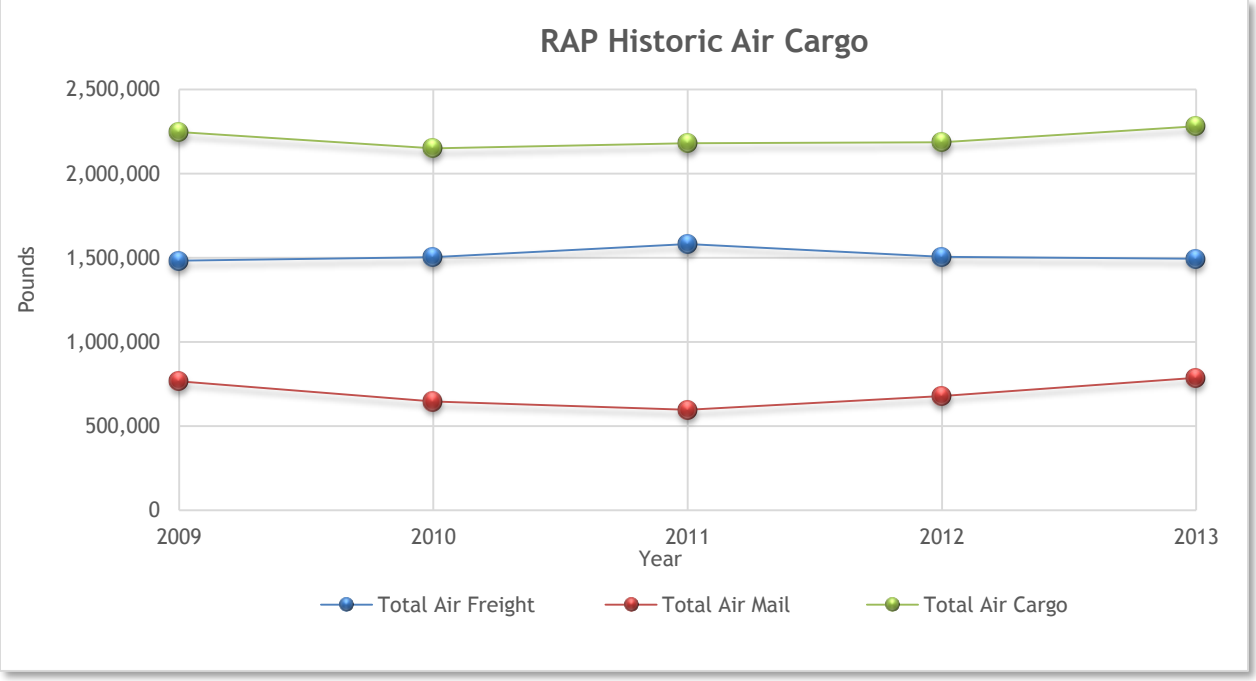
Transporting materials and goods can be accomplished by air, truck, rail, water or a combination of modes. Products that are high value, light weight and time sensitive typically drive air cargo demand. Cargo can be carried on dedicated air freight aircraft or in the belly of commercial service aircraft.

Airport Trends

RAP serves as a feeder for FedEx and UPS from their destination cargo hubs (Sioux Falls). Air cargo arrives in the morning from Sioux Falls on feeder aircraft such as the ATR-42, Cessna 208 Caravan, or Beechcraft 1900 and then is transported via trucks to areas within the service areas. At night the air cargo that is scheduled to be flown out to Sioux Falls arrives and is loaded onto the aircraft for nighttime departures.

Total enplaned and deplaned air freight and mail at RAP has increased 0.3 over the past five years. Over the past five years air cargo operations have dropped from 987 to 728, as both cargo carriers have consolidated flights and removed smaller cargo carrier aircraft from their fleets.

Figure 3-4 – Historic Air Cargo Weight



Source: Rapid City Regional Airport

Table 3-10 – Historical Air Cargo

Historical Air Cargo Table			
Year	**Freight**	**Mail**	**TOTAL**
2008	1,482,698	765,360	2,248,058
2009	1,503,519	646,290	2,149,809
2010	1,582,280	597,541	2,179,821
2011	1,506,055	679,466	2,185,521
2012	1,493,526	787,867	2,281,393
Historical CAGR	*0.14%*	*0.56%*	*0.30%*

Source: Rapid City Regional Airport

Proposed Forecast

Freight & Mail

The recommended forecast assumes growth over the next 20 years representing an increase in weight through RAP to Sioux Falls, SD (FSD). This growth is based on the feeder system currently used by both UPS and FedEx and the population growth forecasted for the air cargo service area.

It is anticipated that the current fleet of aircraft (ATR-42, Cessna 208 Caravan, and the Beechcraft 1900) operating at RAP will continue to operate in the future. These aircraft are perfectly suited to handle the existing and forecasted air cargo for the Rapid City service area. The amount of operations of air cargo aircraft is anticipated to rise back to 2008 numbers as weight increases, up to 1,064 operations in 2033.

Table 3-11 – Forecast Air Cargo

Forecast Air Cargo	
Year	**TOTAL (lbs.)**
2013	2,281,393
2018	2,438,523
2023	2,718,382
2033	3,378,139
Forecast CAGR	*1.91%*

Source: Rapid City Regional Airport, KLJ Analysis

Summary

A summary of the air cargo freight & mail and operations are provided in the following table.

Table 3-12 – Air Cargo Aviation Forecasts Summary

Air Cargo Aviation Forecasts Summary				
Metric	**2013**	**2018**	**2023**	**2033**
Total Cargo (lbs)	2,281,393	2,438,523	2,718,382	3,378,139
Total Operations	728	800	880	1,064

Source: Rapid City Regional Airport, KLJ Analysis

Commercial Forecast Summary

A summary of the commercial aviation forecasts is shown in the following table.

Table 3-13 – Commercial Forecast Summary

Commercial Forecast Summary				
Metric	**2013**	**2018**	**2023**	**2033**
Air Carrier	59,457	63,969	68,754	79,208
Air Taxi/Commuter	196,734	211,665	227,499	262,090
Total Enplanements	256,191	275,634	296,254	341,298
Total Cargo (lbs)	2,281,393	2,438,523	2,718,382	3,378,139
Operations				
Air Carrier	2,148	1,376	1,821	2,187
Air Taxi/Commuter	11,868	12,323	12,258	12,435
Total Commercial Operations	14,016	13,700	14,079	14,623
Avg. Seats/Operation	50.2	53.7	56.1	62.2
Average Load Factor	74.88%	75.00%	75.00%	75.00%

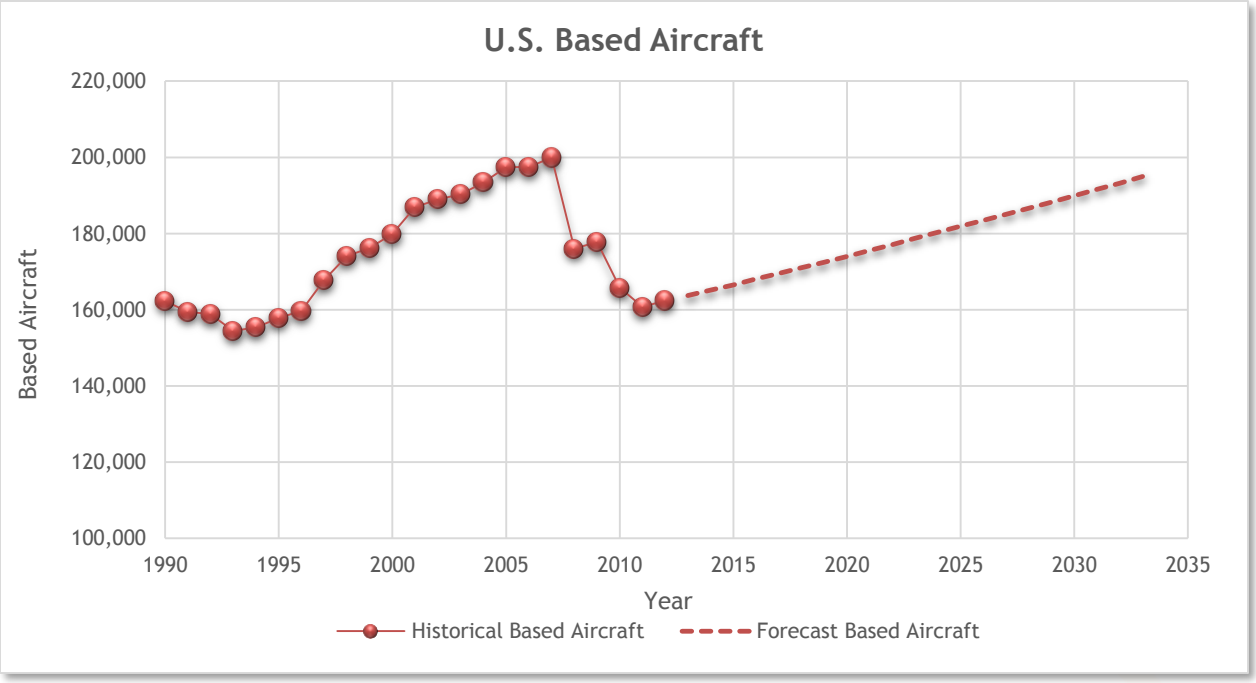
Source: KLJ Analysis

Based Aircraft Forecasts

A based aircraft is an operational and airworthy aircraft based at the airport for a majority of the year. These are generally non-commercial general aviation and commercial air taxi aircraft.

Based aircraft is the count of aircraft that claim a specific airport as its home base. Civil (non-military) based aircraft at Rapid City are used for primarily general aviation (GA) and some Air Taxi (AT) operations. On a national basis, the FAA TAF nationally reports based aircraft hit a 15-year low in 2011 after highs were achieved in 2007. The economic recession contributed to the number of based aircraft declining nearly 20 percent between 2007 and 2011. National forecasts show a modest growth rate of 0.88 percent annually over the next 20 years. Based aircraft had been increasing steadily with decreased growth during economic downturns. The most recent economic recession demonstrates the new sensitivity based aircraft has with the overall economy.

Figure 3-5 – U.S. Based Aircraft



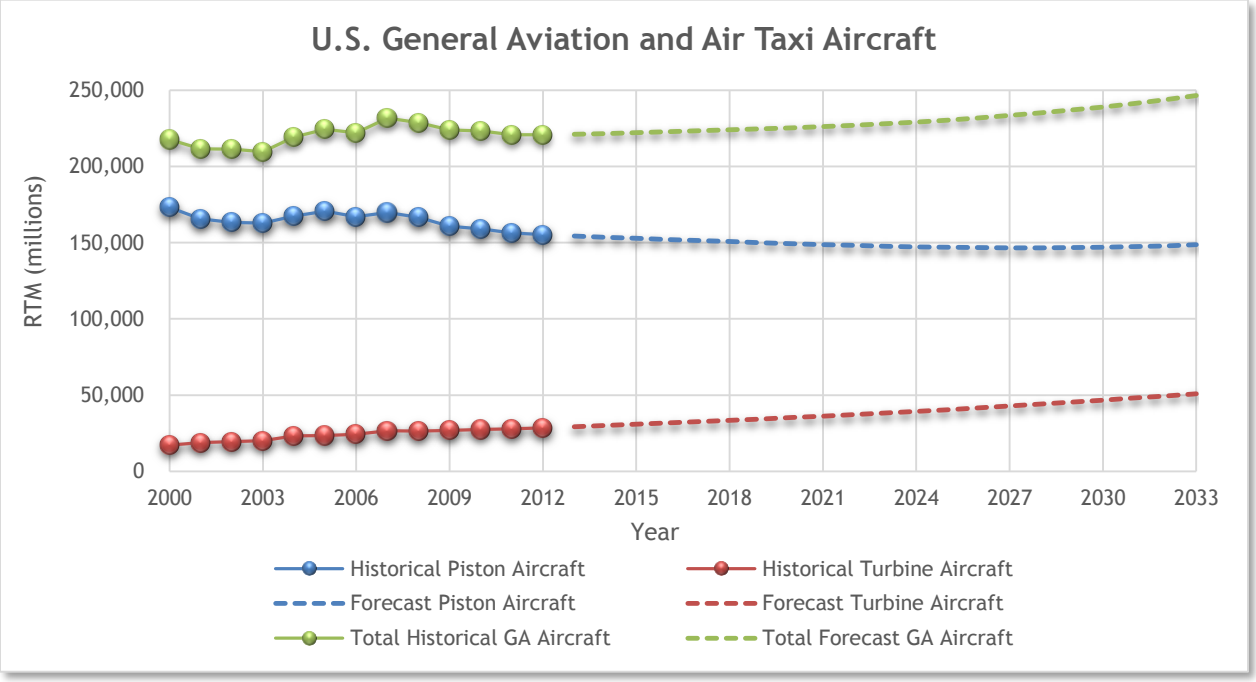
Source: FAA Terminal Area Forecast

Nationally, the total number of general aviation and air taxi active aircraft has cumulatively increased by 1.4 percent since 2000. Events affecting the number of aircraft include increased security regulations since 9/11, the economic downturn of the early 2000s and the recession of the late 2000s. Aircraft types are evolving to include more turboprop and turbojet aircraft and fewer multi-engine piston aircraft.

Within the GA and AT activity category there has been increased demand for the use of turbine powered aircraft. These aircraft include turboprop and turbojet aircraft primarily used for corporate business travel. More operators are using GA aircraft to travel to save

travel time and cost. The number of turbine aircraft has increased an average of 4.3 percent annually. Helicopter, experimental and light sport aircraft (new aircraft category since 2006) have seen steady increases. On the contrary, the number of piston powered aircraft has decreased 1.0 percent annually. These aircraft types are used for recreational and flight training purposes. Decreases can be attributed higher ownership costs, increased fuel prices, economic downturns and a decreasing pilot population. Multi-engine piston aircraft have particularly seen a reduction with decreases of 2.5 percent annually. These aircraft types are being replaced by newer technology turboprop aircraft for business travel.

Figure 3-6 – U.S. General Aviation and Air Taxi Aircraft

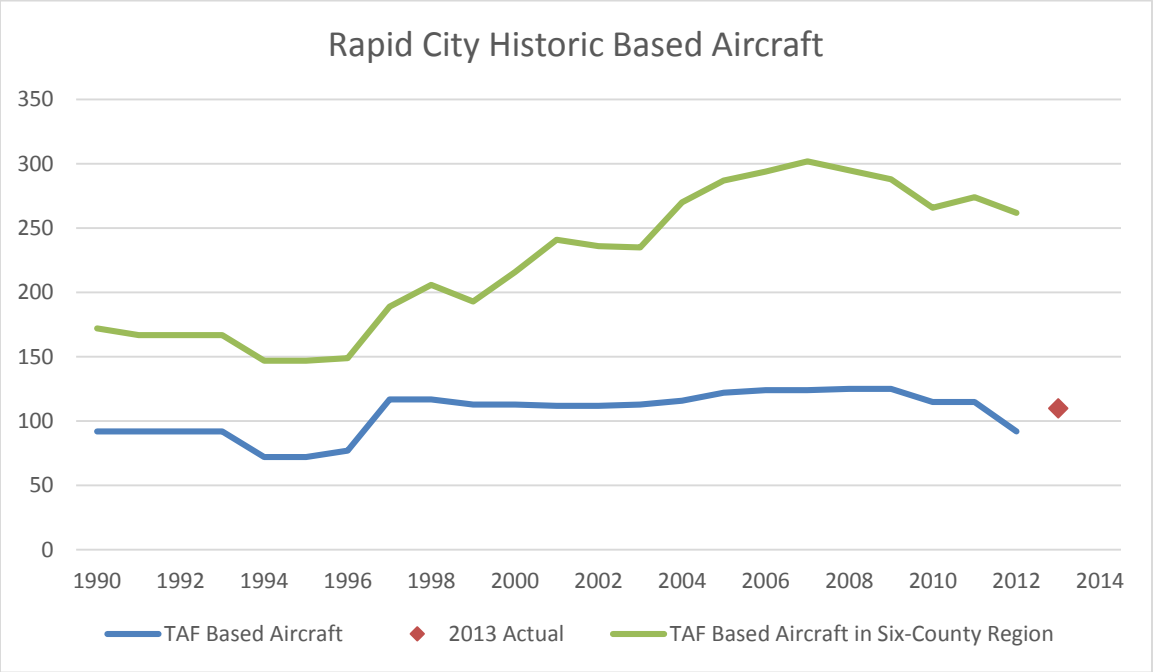


Source: FAA Aerospace Forecasts (2013-2033)

Total 2013 reported Rapid City based aircraft according to FAA Form 5010-1 *Airport Master Record* consists of 70 single-engine, 31 multi-engine, 8 jet aircraft, 1 helicopter and 1 glider for a total of 110 aircraft.

The historic TAF for Rapid City showed a downturn of based aircraft in 2011 to 2012 from 115 down to 92 aircraft. In discussions with Rapid City airport staff it was learned that the based aircraft information for 2012 was gathered by sending mailings to all aircraft known to be based at the airport. The 2012 based aircraft numbers were recorded as a result of those aircraft owners' responding. If an aircraft owner did not respond or was otherwise not known to airport, it was not recorded as a based aircraft in 2012. As a result, the 2012 based aircraft number of 92 aircraft appears to be an error in data collection and not a correct representation of the aircraft at the airport in that year.

Figure 3-7 – Rapid City Based Aircraft



Source: FAA Terminal Area Forecast, RAP Airport Master Record (2013), Six-County Region is Butte, Custer, Fall River, Lawrence, Meade and Pennington Counties with Belle Fourche, Custer, Hot Springs, Rapid City, Spearfish, Sturgis and Wall airports.

Forecasts

Based aircraft forecasts measure the number of aircraft that claim Rapid City as their home airport. Forecast methodologies evaluated include time series (trend) and market share analysis. Not enough accurate historic data is available for a regression analysis. Data used include based aircraft data from the airport records, FAA TAF, FAA Aerospace Forecasts, demographic and socioeconomic data.

The 2013 FAA TAF published for Rapid City reports 93 based aircraft with a future growth rate of 1.64 percent annually. Based aircraft figures vary from source to source. FAA Form 5010-1 *Airport Master Record* reports 111 based aircraft in 2013 which is determined to be the baseline figure.

Regional

An important local and regional consideration is the stagnant level of based aircraft at Rapid City in comparison to the six-county. Increases occurred in the region in 1998, 2001 and 2007 but did not occur at Rapid City. This has resulted in based aircraft locating at surrounding airports other than Rapid City. This will have an effect on the forecast based aircraft at Rapid City. There were two particular airports mentioned most in discussions about where pilots are basing aircraft.

- Black Hills Airport (SPF): SPF is in Spearfish, SD located 41 nautical miles northwest of RAP. This facility has a 6,401 foot long runway with two non-precision GPS approaches.

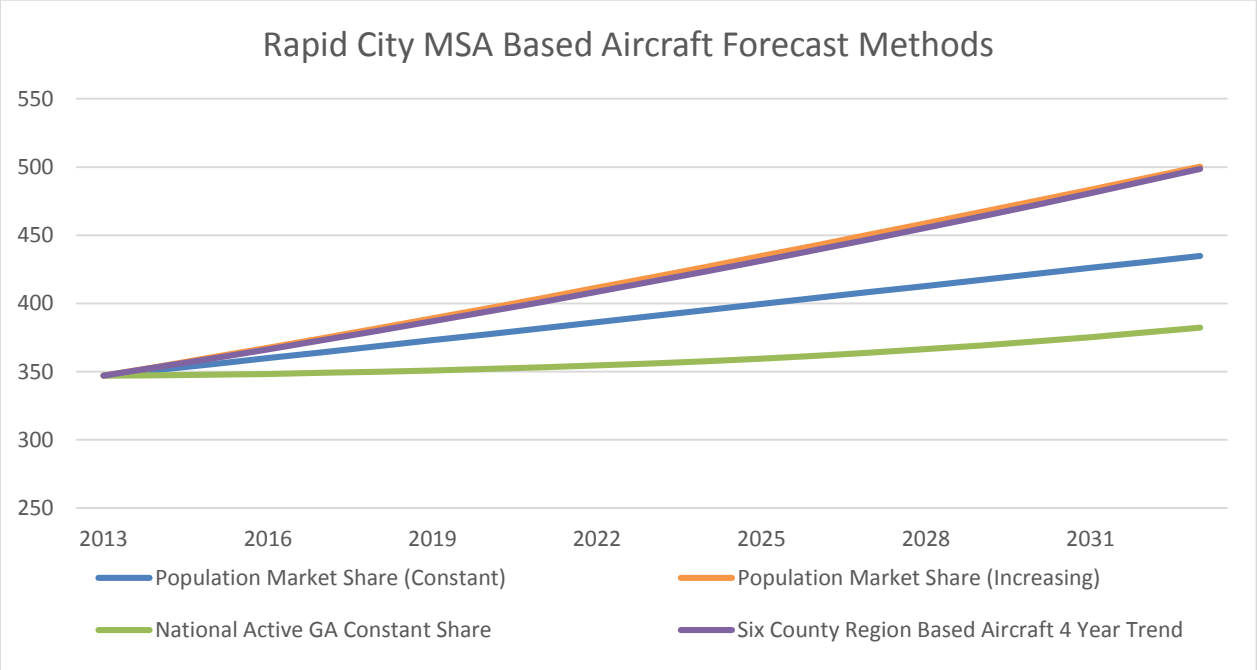
According to the FAA TAF, based aircraft at SPF has increased rapidly from 52 to 72 over the past 20 years for an average growth rate of 1.64 percent annually. From Rapid City it is a 45 mile (47 minute) drive.

- Hot Springs Airport (HSR): HSR is in Hot Springs, SD located 42 nautical miles south of RAP. This facility has a 4,506 foot long runway and 22 based aircraft with two non-precision GPS approaches. According to the FAA TAF, based aircraft at HSR has increased rapidly from 10 to 22 over the past 20 years for an average growth rate of 4.02 percent annually. From Rapid City it is a 54 mile (54 minute) drive.

- In comparison Rapid City Regional Airport is east of the city. It is a 10 mile (15 minute) drive to Rapid City Regional Airport from the central business area.

There are three factors which are believed to have limited based aircraft growth at Rapid City. These are first the lack of space to develop, since the airport is on a low plateau with additional cost to fill and level land for hangar development. Second is the airport is now in the City of Rapid City and recently, as of 2005, was required to abide by city building codes. Third is the change in security as a result of 9-11. If the first two factors are addressed it is believed that additional based aircraft will quickly be added.

Figure 3-8 - Rapid City MSA Based Aircraft Forecast Methods



Source: FAA TAF, KLJ Analysis

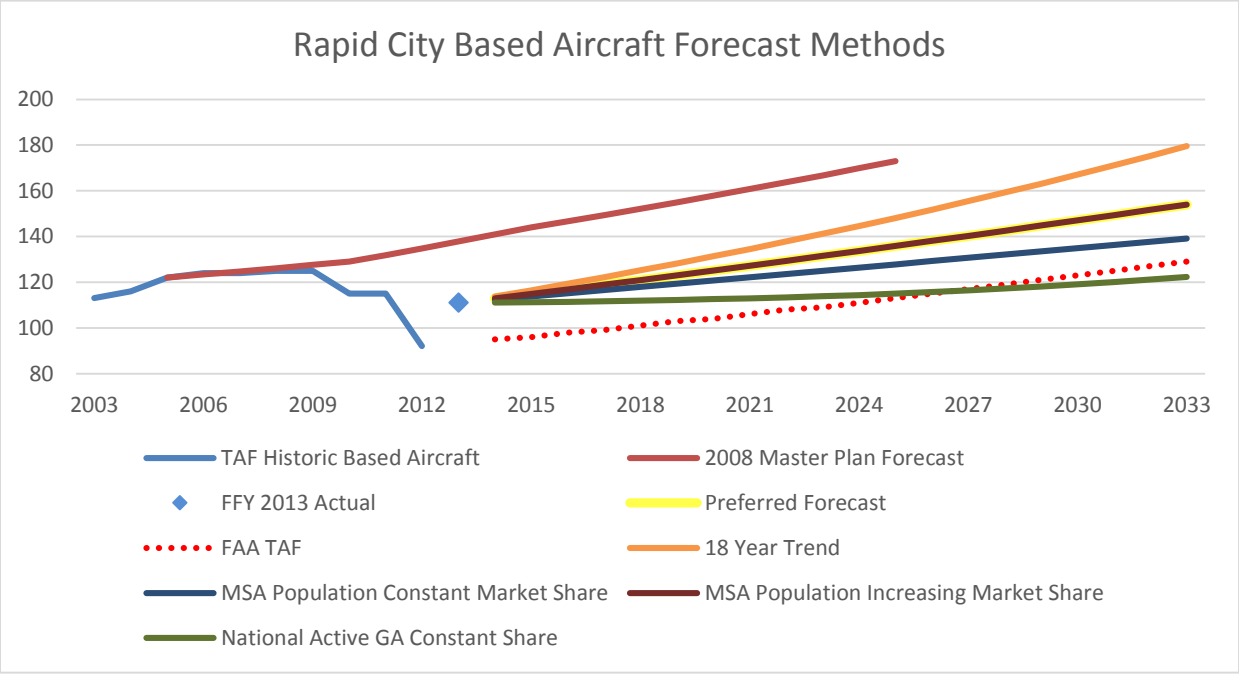
Rapid City MSA regional based aircraft forecasts were first developed to determine the regional demand for based aircraft facilities. Using FAA records there were 347 registered aircraft within the MSA. Several market share methods were reviewed to estimate future

registered aircraft including constant population market share, increasing population market share, national active GA and AT aircraft market share and historical regional trends using available data.

Local

To determine the forecast based aircraft at Rapid City for the next 20 years the airport's share of total registered aircraft was considered since Rapid City is currently the base for approximately 32 percent of the MSA's registered aircraft. This implies that a large number of aircraft could choose Rapid City as their base if space was available. Forecasts for based aircraft used MSA population projections and a constant share of the national active GA fleet.

Figure 3-9 – Rapid City Based Aircraft Forecast Methods



Source: KLJ Analysis, Rapid City Airport Master Record (2013), FAA Terminal Area Forecast

Various methods were used for the preferred forecast. It is estimated Rapid City based aircraft will grow at a marginal growth rate for the short-term following historical trends. New based aircraft will include a variety of aircraft types. Rapid City based aircraft is forecast to grow from 111 currently to 154 at the end of the forecast period for an average annual growth rate of 1.84 percent.

Table 3-14 – Based Aircraft Forecast

Based Aircraft Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Total Based Aircraft	111	121	132	154

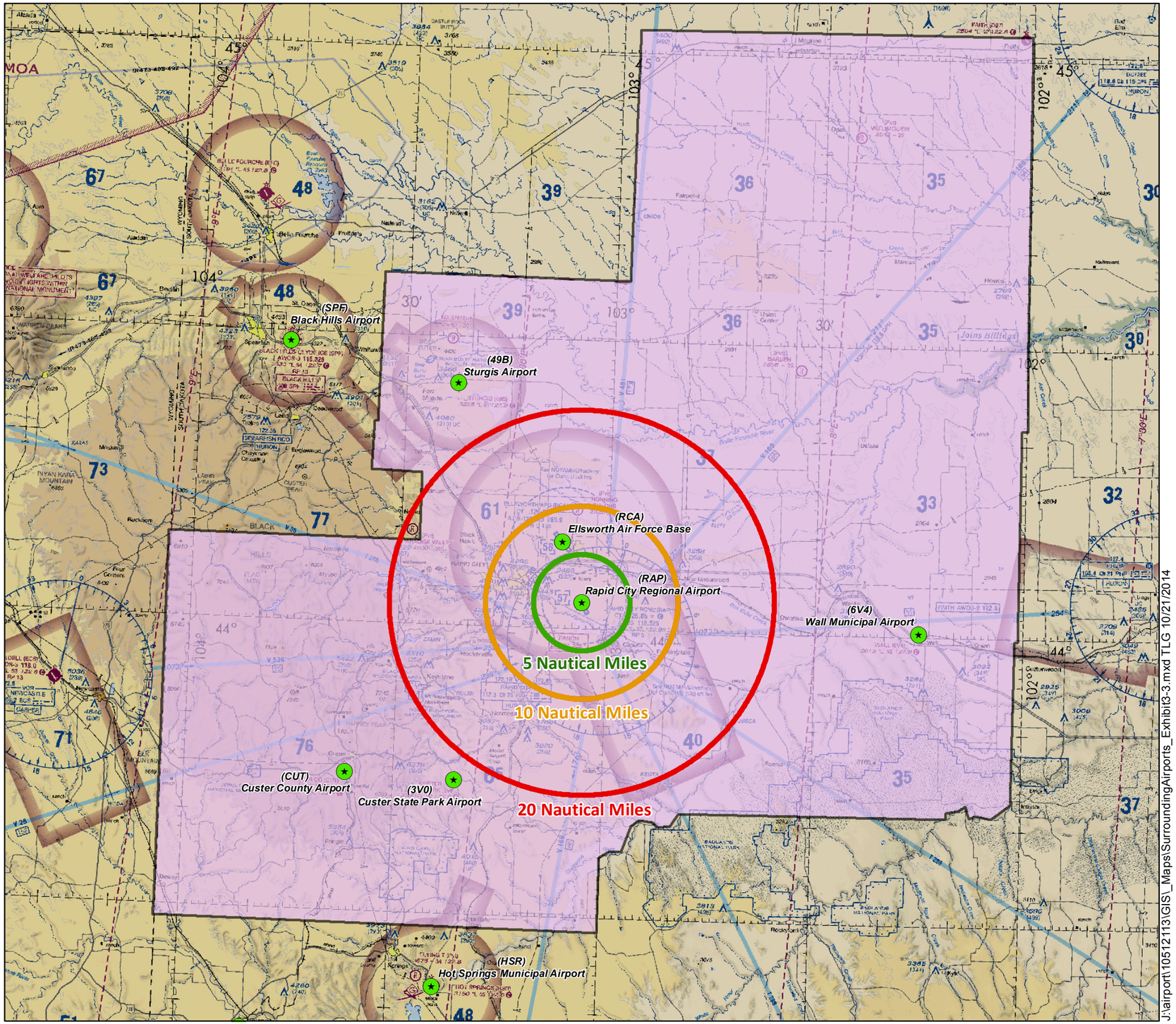
Source: KLJ Analysis

As Rapid City and the industry see more turboprop and turbojet aircraft, the airport's based aircraft fleet mix will also change. It is forecast multi-engine and jet aircraft types will increase at a faster rate than single-engine aircraft. Single engine growth will be tempered at 1.32 percent, multi-engine aircraft will grow at 2.10 percent and jet aircraft will grow at 3.48 percent through the forecast period. *The based aircraft forecasts are considered consistent with the TAF*.

Table 3-15 – Rapid City Based Aircraft Fleet Mix Forecast

Rapid City Based Aircraft Fleet Mix Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Single-Engine*	70	75	75	91
Multi-Engine*	31	34	36	47
Jet	8	10	11	15
Helicopter	1	1	0	0
Other	1	1	1	1
Total Based Aircraft	**111**	**121**	**125**	**154**

Source: KLJ Analysis
**Includes both piston and turboprop driven aircraft for FAA reporting purposes*



Legend

Rapid City MSA

Rapid City Regional Airport (RAP)
-111 Based Aircraft
- 8,701 - foot Primary Runway, Runway 32 ILS
- Commercial Service Airport

Ellsworth Air Force Base (RCA)
- 13,497-foot Primary Runway, ILS Approaches
- Military Airport

Black Hills Airport (SPF)
-72 Based Aircraft
- 6,401-foot Primary Runway, ILS Approaches
- General Aviation Service Airport

Hot Springs Airport (HSR)
- 22 Based Aircraft
- 4,506-foot Primary Runway
- General Aviation Service Airport

N

0 5 10 20 Miles

*Intended for Planning Purposes Only

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KLJ

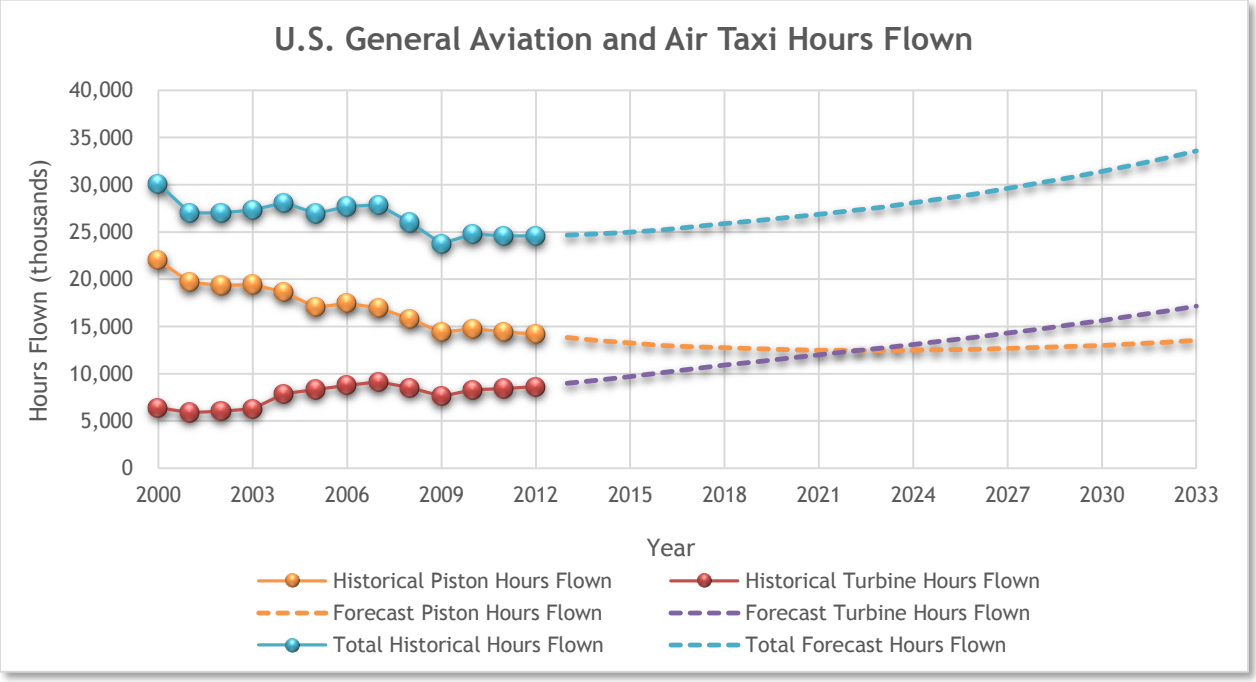
Rapid City Regional Airport
Surrounding Airports Map
Exhibit 3-3

General Aviation Operations Forecast

Historic Aviation Activity & Trends

General aviation (GA) is defined as aviation activities other than for commercial purposes. These are typically recreational or private transport flights. Nationally, the number of general aviation and air taxi hours flown has decreased by 18 percent since 2000. This downturn can be attributed to the economic downturn of the early 2000s, the recession of the late 2000s and increasing operating costs including fuel prices.

Figure 3-10 – U.S. General Aviation and Air Taxi Hours Flown



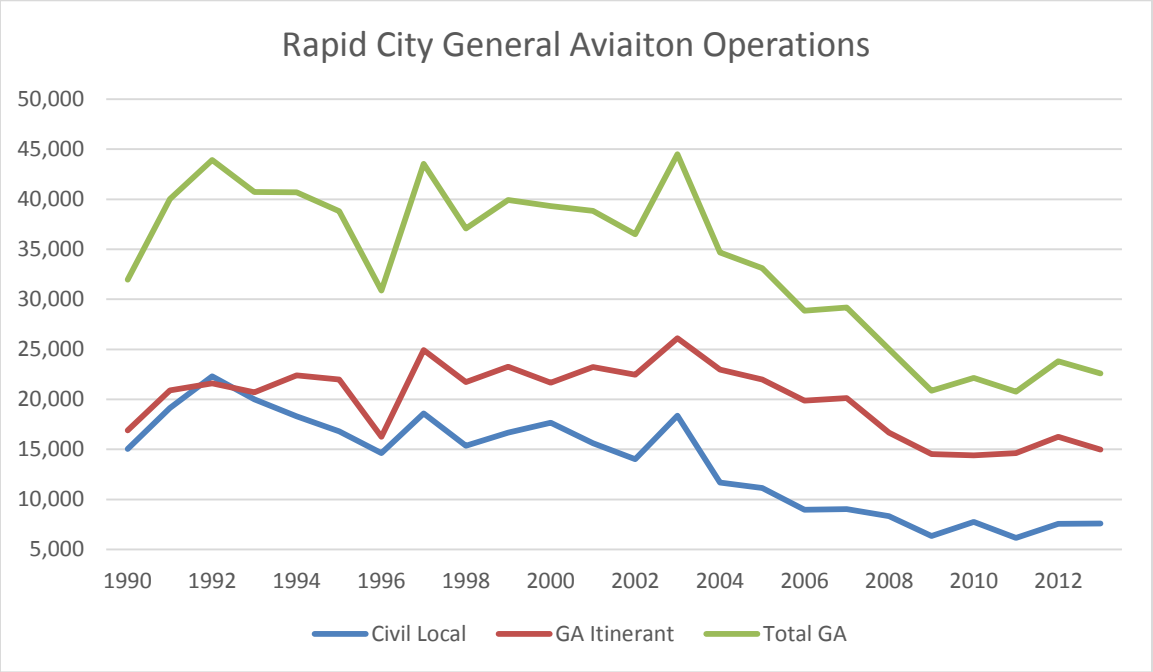
Source: FAA Aerospace Forecasts (2013-2033)

Within the GA and AT activity category there has been increased demand for the use of turbine powered aircraft. These aircraft include turboprop and turbojet aircraft primarily used for corporate business travel. More operators are using GA aircraft to travel to save travel time and cost. The number of turbine aircraft has increased an average of 4.3 percent annually. Helicopter, experimental and light sport aircraft (new aircraft category since 2006) have seen steady increases. On the contrary, the number of piston powered aircraft has decreased 1.0 percent annually. These aircraft types are used for recreational and flight training purposes. Decreases can be attributed higher ownership costs, increased fuel prices, economic downturns and a decreasing pilot population. Multi-engine piston aircraft have particularly seen a reduction with decreases of 2.5 percent annually. These aircraft types are being replaced by newer technology turboprop aircraft for business travel.

The trend of strong growth in corporate aircraft and steady or decreased use of piston aircraft is expected to continue over the planning period. This forecast may fluctuate with new unleaded fuel engines potentially reducing the cost of flying. The number of turbojet aircraft

is expected to increase 3.5 percent annually with hours flown increasing at a 4.3 percent rate. Larger corporate GA aircraft types is forecast to grow in number and activity levels. Piston aircraft is expected to decrease at a rate of 0.3 percent annually with activity decreasing at a 0.5 percent annual rate. This decrease can be attributed in part to upgrades to new aircraft type but also to the increased cost of flying and activity sensitivity to economic conditions.

Figure 3-12 – Rapid City General Aviation Operations Breakdown



Source: FAA Air Traffic Activity Data System (ATADS) *Assumes Civil local operations are all general aviation

At Rapid City, GA operations have decreased since peaks occurred in 1992, 1997 and 2003.

Forecasts

Local Operations

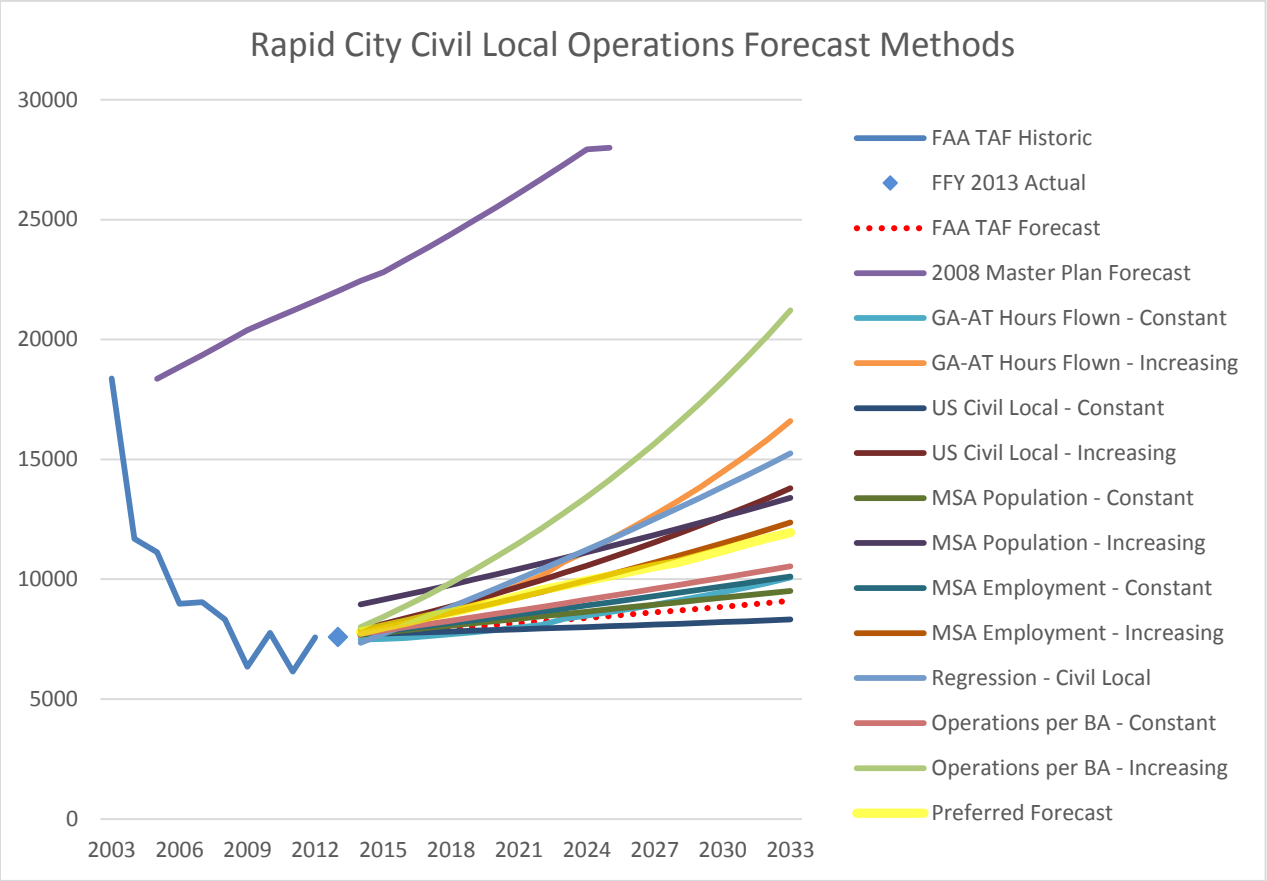
A local operation is defined as a takeoff or landing of a flight conducted within 20 miles of an airport. These operations typically include practice landings, touch-and-go's, practice approaches and maneuvering in the local area. Civil local operations are usually conducted by recreational and flight training aircraft.

Civil local operations have been declining in the recent years with a low figure achieved in 2011 with 6,148 operations. There was a drop of over 12,000 operations from 2003 to 2011. The FAA TAF projects future operations will steadily grow at about a 0.9 percent annual rate.

Several forecast methods were evaluated to estimate future operations including share analysis and regression. Share analysis reviewed historical civil local operations to various

metrics including Operations Per Based Aircraft (OPBA), total U.S. GA and AT hours flown, total U.S. civil local operations, MSA population and MSA employment in an attempt to develop a realistic forecast.

Figure 3-13 – Rapid City Civil Local Operations Forecast Methods



Source: FAA Terminal Area Forecast, 2008 Airport Master Plan, KLJ Analysis

The preferred forecast assumes Civil Local operations at Rapid City will be consistent with the MSA population share. This method yields an average annual growth rate of 2.28 percent. *The local operations forecast is considered consistent with the TAF*.

Itinerant Operations

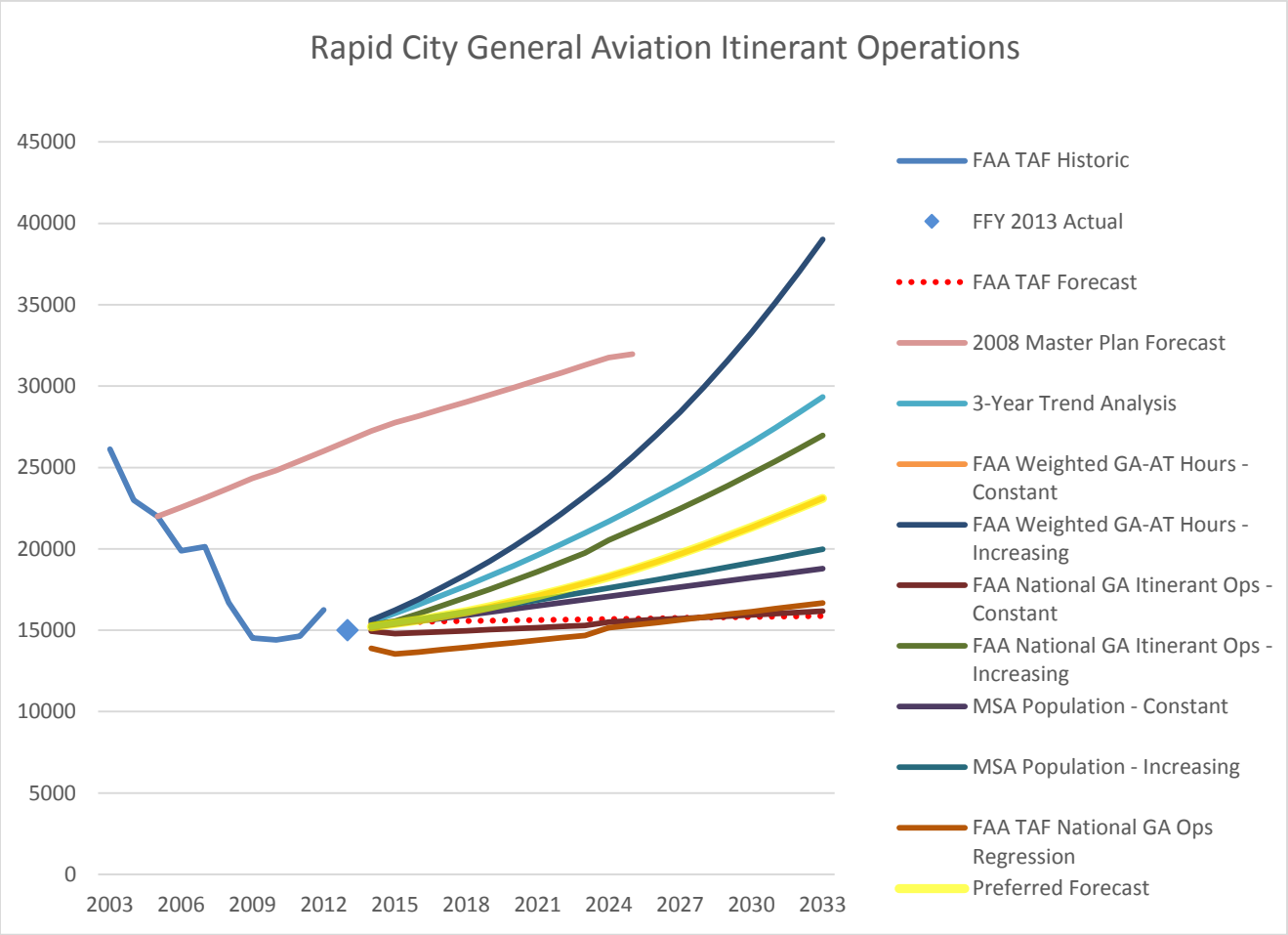
A GA itinerant operation is defined a takeoff or landing of a flight conducted beyond 20 miles of an airport, usually from another airport. GA itinerant operations are conducted by all types of aircraft. Commercial flights are almost exclusively considered itinerant operations.

GA itinerant operations have been declining in the recent years with a low figure achieved in 2010 with 14,402 operations. This can be attributed in part to the decrease in overall GA activity as a result of higher operating costs and the loss of the local flight school. The FAA TAF projects future operations will steadily grow at about a 0.28 percent annual rate.

Several forecast methods were evaluated to estimate future operations including trend analysis, share analysis and regression. Trend analysis reviewed trends over the past three,

five and ten years. Share analysis reviewed historical GA itinerant operations to various metrics including total U.S. GA and AT hours flown, total U.S. GA itinerant operations, MSA population and MSA employment to develop a realistic forecast considering available metrics.

Figure 3-14 – Rapid City General Aviation Itinerant Operations Forecast Methods



Source: FAA Terminal Area Forecast, 2008 Airport Master Plan, KLJ Analysis

The preferred forecast is based on a midpoint between the National Weighted GA and AT Hours Flown – Increasing and the MSA Population Share – Increasing. This method yields an average annual growth rate of 2.18 percent. *The itinerant forecast is considered consistent with the TAF*.

Fleet Mix

The overall general aviation operations fleet mix combines local and itinerant operations using estimated percentages.

Turbojet operations make up the majority of forecast general aviation operations at Rapid City with approximately 42 percent followed by turboprop at 23 percent.

Table 3-16 – Total Operations Fleet Mix Forecast

General Aviation Operations Fleet Mix Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Single-Engine Piston	7,270	8,220	9,360	10,450
Multi-Engine Piston	3,320	3,490	3,720	3,940
Turboprop	7,800	8,420	9,330	10,540
Turbojet	17,670	17,740	18,630	19,710
Helicopter	1,200	1,300	1,450	1,630
Other	80	90	100	110
Total Operations	**37,340**	**39,260**	**42,590**	**46,380**

Source: KLJ Analysis

Forecast Summary

A summary of the civil local and general aviation itinerant forecasts is shown in the following table.

Table 3-17 – General Aviation Operations Forecast Summary

General Aviation Operations Forecast Summary				
Metric	**2013**	**2018**	**2023**	**2033**
Local Operations	7,593	8,604	9,750	11,941
Itinerant Operations	14,997	16,153	17,878	23,102
Total Operations	**22,590**	**24,757**	**27,628**	**35,043**
Local Share	33.61%	34.75%	35.29%	34.07%
Itinerant Share	66.39%	65.25%	64.71%	65.93%

Source: KLJ Analysis

Military Operations

Proposed Forecast

Military missions are difficult to predict but the local SDANG base is expected to remain at RAP for the foreseeable future. Total, local and itinerant military operations were forecast to remain steady and follow average figures from the last 10 years assuming the same type of mission will occur at RAP. Total operations are forecast to remain at 4,024 for the planning period. Itinerant operations make up about 67 percent of the total with local operations at 33 percent based on historical trends.

Military based aircraft is forecast to remain steady at 13 (six UH-72 Lakota helicopters, six UH-60 Blackhawk helicopters, and one C12 Huron aircraft) through the planning period.

The preferred forecast for military operations is considered consistent with the 2013 FAA TAF.

Annual Instrument Approaches

Annual instrument approaches (AIAs) are defined as an approach to an airport conducted in actual instrument meteorological conditions. For purposes of this definition, an approach initiated when the observed visibility is less than 3 miles or the cloud ceiling is less than the decision altitude over the final approach fix (3,100 feet mean sea level for RAP) is considered an instrument approach. AIA figures for RAP are no longer tracked by the local Air Traffic Control Tower but are required element to an FAA forecast.

To determine AIAs, the number of itinerant operations are totaled from the estimates and forecasts and compared to annual operations. The number of instrument flights are determined. Approximately 80 percent of all RAP itinerant flight operations are conducted under instrument flight rules (IFR) according to FAA records. Local weather conditions are then reviewed. A total of 13.23 percent of the hourly weather observations are in instrument conditions for an instrument approach.

Table 3-18 – Annual Instrument Approach Forecast

Annual Instrument Approach Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Annual Operations	41,358	43,280	46,610	54,753
Itinerant Operations	32,111	33,340	35,524	41,476
% IFR Itinerant Operations	84.00%	84.00%	84.00%	84.00%
IFR Itinerant Operations	26,973	28,006	29,840	34,840
IFR Approaches	13,486	14,003	14,920	17,420
Instrument Approach Weather	13.23%			
Annual Instrument Approaches	**1,784**	**1,853**	**1,974**	**2,305**
AIA as Percent of Itinerant	**5.56%**	**5.56%**	**5.56%**	**5.60%**

Source: National Climatic Data Center, FAA Air Traffic Activity Data System (ATADS), KLJ Analysis

Total AIAs for RAP are forecast to increase from 1,784 currently estimated to 2,305 at the end of the planning period for an average annual growth rates of 1.29 percent annual rate.

Peak Activity

Peak periods evaluated include the peak month, design day and design hour characteristics for passenger enplanements and airport operations. The results of the peak activity forecasts will be used to determine the airport facility requirements. The methodology developed is derived from the Airports Cooperative Research Program (ACRP) Report 25: *Airport Passenger Terminal Planning and Design*, which emphasizes the use of design periods to forecast use patterns rather than individual absolute peak periods.

Local data used includes these aviation forecasts, FAA Air Traffic Activity Data System (ATADS), as well as RAP flight schedules from February and July 2014 along with monthly activity reports provided by the airport.

Passenger Airlines

Peak Month

The peak month of passenger airline activity was determined by reviewing the prior three years of monthly passenger enplanement figures for the airport. This method evaluates historic patterns of passenger activity to identify the peak month. The peak month was determined to be July 2014 with 12.22 percent of the annual enplanements for fiscal year 2011, consistent with the fiscal year periods evaluated in this forecast effort. This figure applies to both passengers and operations.

Table 3-19 – Peak Month Passenger Airline Activity Forecast

Peak Month Passenger Airline Activity Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Annual Enplanements	256,191	275,634	296,254	341,298
Peak Month (12.22%)	31,255	33,627	36,143	41,638

Source: KLJ Analysis

Design Day

The average peak weekday during the peak month is considered the design day. Design day activity is determined by evaluating actual flight schedules rather than using a pure average or an individual daily peak. Reviewing the average day during the peak month allows for planning for a peaking period rather than a single event which may cause overestimating. Peak days occur on weekdays for the sample periods at RAP.

There are currently 14 airline departures during the average peak weekday. Using the July 2014 flight schedule, this consists of 14.28 percent of the overall weekly departures. This baseline figure matches up to current design day operations for the peak summer months.

The average weekday percentages are annualized based on 12 months and 52 weeks per year to determine the design day forecasts. The enplanements forecast for the design day is summarized in the following table.

Table 3-20 – Design Day Passenger Airline Activity Forecast

Design Day Passenger Airline Enplanement Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Peak Month Enplanements (12.22%)	31,255	33,627	36,143	41,638
Avg. Week Peak Month Enplanements	7,213	7,760	8,341	9,609
Design Day (14.3%) Enplanements	1,031	1,110	1,193	1,374
Peak Month Operations	1,713	1,674	1,720	1,787
Avg. Week Peak Month Operations	395	386	397	412
Design Day (15.0%) Operations	59.6	58.3	59.9	62.2

Source: KLJ Analysis

Design Hour

The design hour is based on the flight schedules during a design day. Using the terminal planning guidance from ACRP Report 25, peak hour assumes passengers arrive to the airport 60 minutes prior to departure and remain at the airport up to 60 minutes after arrival. The July 2014 flight schedule was used to review a rolling peak in 10 minute intervals.

There are four airline flight operations (four departures) during the design hour. The design hour makes up 9 percent of the 60 actual design day airline flight operations. The passenger and operations forecast for the design hour are summarized in the following table.

Table 3-21 – Design Hour Activity

Design Hour Activity Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Peak Month Design Day Enplanements	1,031	1,110	1,193	1,374
Design Hour Enplanements (19.5%)	201	216	233	268
Design Day Operations	59.6	58.3	59.9	62.2
Design Hour Operations (9.0%)	5.4	5.2	5.4	5.6

Source: KLJ Analysis

Design hour passenger activity determinations are especially important for terminal space planning. This will be evaluated further in the Facility Requirements chapter.

Airport Operations

Peak Month

The peak month of airport operations was determined by reviewing the prior three years of monthly airport operations figures from the Air Traffic Control Tower. This method evaluates historic patterns of airport operations activity to identify the peak month. The peak month was determined to be July 2014 with 10.19 percent of the annual operations for fiscal year 2014, consistent with the fiscal year periods evaluated in this forecast effort. Peak month airport operations forecast based on the three year historic operations peak outlined in the following table.

Table 3-22 – Peak Month Operations Forecast

Peak Month Operations Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Annual	14,016	13,700	14,079	14,623
Peak Month (12.22%)	1,713	1,674	1,720	1,787

Source: KLJ Analysis

Design Day

Using the July 2012 Air Traffic Control Tower peak data, the top 10 peak days consist of 2,081 operations for an average of 208.1 daily operations. The average of the top 10 days in the peak month will be considered the design day. This consists of 4.94 percent of the monthly operations.

Table 3-23 – Design Day Operations Forecast

Design Day Operations Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Peak Month	4,214	4,410	4,750	5,579
Design Day (4.94%)	208	218	235	276

Source: KLJ Analysis

Design Hour

The design hour is based on the average hourly operations during a design day. To determine this figure, the average hourly operations were reviewed for the peak month, July 2012.

Table 3-24 – Design Hour Operations Characteristics

Design Hour Operations Characteristics		
Design Hour Operations	**Daily Average**	**Percent of Daily**
21	208	10.0%

Source: FAA Enhanced Traffic Management System Counts (FTMSC), RAP ATCT, KLJ Analysis

Using the design hour methodology developed, the design hour operations forecast is then developed and identified below.

Table 3-25 – Design Hour Operations Forecast

Design Hour Operations Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Design Day	218	235	235	276
Design Hour (10.0%)	21	22	23	28

Source: KLJ Analysis

General Aviation Peaking Tendencies

Peak Month

The peak month of general aviation operations was determined by reviewing the prior three years of monthly airport operations figures from the Air Traffic Control Tower. This method evaluates historic patterns of airport operations activity to identify the peak month. The peak

month was determined to be July 2013 with 10.98 percent of the annual general aviation operations for fiscal year 2013.

Table 3-26 – Peak Month GA Operations Forecast

Peak Month GA Operations Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Annual	22,590	24,757	27,628	35,043
Peak Month (10.98%)	2,480	2,718	3,034	3,848

Source: KLJ Analysis

Design Day

Using the July 2013 Air Traffic Control Tower peak data, the top 10 peak days consist of 814 operations for an average of 81.4 daily operations. The average of the top 10 days in the peak month will be considered the design day. This consists of 4.19 percent of the monthly operations.

Table 3-27 – Design Day Operations Forecast

Design Day Operations Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Peak Month	2,480	2,718	3,034	3,848
Design Day (4.19%)	104	114	127	161

Source: KLJ Analysis

Design Hour

The design hour is based on the average hourly operations during a design day. Discussions with the Air Traffic Control Tower determined that approximately 20 percent of total daily activity would be a good estimate.

Using the design hour methodology developed, the design hour operations forecast is then developed and identified below.

Table 3-28 – Design Hour GA Operations Forecast

Design Hour Operations Forecast				
Metric	**2013**	**2018**	**2023**	**2033**
Design Day	104	114	127	161
Design Hour (20.0%)	21	23	25	32

Source: KLJ Analysis

Forecast Summary

The FAA templates to compare the proposed forecasts to the 2013 published FAA Terminal Area Forecast follow. The Aviation Forecasts were approved by the FAA on April 16, 2015 for use in this master planning effort.

Rapid City Regional Airport (RAP)							Airport Master Plan Forecast		
Rapid City, SD									10/21/2014
Aviation Forecasts									
A. Forecast Levels and Growth Rates									
		Specify base year:		2013	(Federal Fiscal Year)				
						Average Annual Compound Growth Rates			
	2013	2018	2023	2028	2033	2018	2023	2028	2033
Passenger Enplanements									
Air Carrier	59,457	63,969	68,754	73,832	79,208	1.47%	1.46%	1.45%	1.44%
Commuter	196,734	211,665	227,499	244,301	262,090	1.47%	1.45%	1.44%	1.42%
TOTAL	256,191	275,634	296,254	318,133	341,298	1.47%	1.46%	1.45%	1.44%
Operations									
Itinerant									
Air Carrier	2,148	2,177	2,701	2,841	3,251	0.26%	4.41%	1.02%	2.73%
Commuter/Air Taxi	12,596	12,323	12,258	12,617	12,435	-0.44%	-0.27%	0.01%	-0.06%
Total Commercial Operations	14,744	14,500	14,959	15,458	15,686	-0.33%	0.63%	0.66%	0.29%
General Aviation - Fixed Wing	13,947	15,022	16,626	18,801	21,485	1.50%	1.77%	2.01%	2.18%
General Aviation - Rotorcraft	1,050	1,131	1,251	1,415	1,617	1.50%	2.05%	2.49%	2.71%
Military	2,688	2,688	2,688	2,688	2,688	0.00%	0.00%	0.00%	0.00%
Total Itinerant Operations	32,429	33,340	35,524	38,361	41,476	0.56%	1.28%	1.55%	1.57%
Local									
General Aviation - Fixed Wing	7,441	8,432	9,555	10,484	11,702	2.53%	2.53%	2.31%	2.29%
General Aviation - Rotorcraft	152	172	195	214	239	2.53%	2.53%	2.31%	2.29%
Military	1,336	1,336	1,336	1,336	1,336	0.00%	0.00%	0.00%	0.00%
Total Local Operations	8,929	9,940	11,086	12,034	13,277	2.17%	2.19%	2.01%	2.00%
TOTAL OPERATIONS	41,358	43,280	46,610	50,396	54,753	0.91%	1.20%	1.33%	1.41%
Annual Instrument Approaches	1,784	1,853	1,974	2,132	2,305	0.75%	1.02%	1.19%	1.29%
Peak Hour Operations	21	22	23	25	28	0.91%	1.20%	1.33%	1.41%
Cargo/mail (enplaned + deplaned tons)	2,281,393	2,438,523	2,718,382	3,030,358	3,378,139	1.34%	1.77%	1.91%	1.98%
Based Aircraft									
Single Engine	70	75	75	86	91	1.41%	0.70%	1.35%	1.32%
Multi Engine	31	34	36	44	47	1.78%	1.58%	2.36%	2.10%
Turbojet	8	10	11	13	15	4.48%	3.77%	3.40%	3.48%
Helicopter	1	1	1	0	0	-	-	-	-
Other	1	1	1	1	1	-	-	-	-
TOTAL	111	121	125	143	154	1.70%	1.17%	1.72%	1.66%
B. Operational Factors									
	2013	2018	2023	2028	2033				
Average aircraft size (seats)									
Air Carrier	120.6	119.0	120.1	120.1	120.1	-0.27%	-0.04%	-0.03%	-0.02%
Commuter	42.7	46.5	46.9	49.6	52.4	1.73%	0.93%	1.01%	1.02%
Average enplaning load factor									
Air Carrier	74.45%	74.00%	74.00%	74.00%	74.00%	-0.12%	-0.06%	-0.04%	-0.03%
Commuter	76.15%	75.00%	75.00%	75.00%	75.00%	-0.30%	-0.15%	-0.10%	-0.08%
GA operations per based aircraft	204	205	221	216	227	0.15%	0.85%	0.39%	0.55%

Table 3-30 – Aviation Forecast Comparison to FAA TAF

Rapid City Regional Airport (RAP)			Master Plan Forecast	
Comparing Airport Planning and FAA TAF Forecasts				10/21/2014
	Year	Airport Forecast	FAA Terminal Area Forecast (TAF)	AF/TAF (% Difference)
Passenger Enplanements				
Base yr.	2013	256,191	251,883	1.71%
Base yr. + 5yrs.	2018	275,634	271,337	1.58%
Base yr. + 10yrs.	2023	296,254	292,302	1.35%
Base yr. + 15yrs.	2028	318,133	314,894	1.03%
Base yr. + 20yrs.	2033	341,298	339,237	0.61%
Growth Rate		*1.44%*	*1.50%*	
Commercial Operations				
Base yr.	2013	14,744	14,686	0.39%
Base yr. + 5yrs.	2018	14,500	15,420	-5.97%
Base yr. + 10yrs.	2023	14,959	16,194	-7.63%
Base yr. + 15yrs.	2028	15,458	17,016	-9.16%
Base yr. + 20yrs.	2033	15,686	17,874	-12.24%
Growth Rate		*0.31%*	*0.99%*	
Itinerant Operations				
Base yr.	2013	32,429	32,661	-0.71%
Base yr. + 5yrs.	2018	33,340	33,961	-1.83%
Base yr. + 10yrs.	2023	35,524	34,840	1.96%
Base yr. + 15yrs.	2028	38,361	35,767	7.25%
Base yr. + 20yrs.	2033	41,476	36,730	12.92%
Growth Rate		*1.24%*	*0.59%*	
Total Operations				
Base yr.	2013	41,358	41,908	-1.31%
Base yr. + 5yrs.	2018	43,280	43,558	-0.64%
Base yr. + 10yrs.	2023	46,610	44,804	4.03%
Base yr. + 15yrs.	2028	50,396	46,116	9.28%
Base yr. + 20yrs.	2033	54,753	47,482	15.31%
Growth Rate		*1.41%*	*0.63%*	

Chapter 4: Facility Requirements

Introduction

This chapter of the Airport Master Plan analyzes the existing and anticipated future facility needs at the Rapid City Regional Airport (RAP). This chapter is divided into sections that assess the needs of primary airport elements including airside facilities, passenger terminal complex, air cargo facilities, general aviation facilities, landside elements and support facilities.

Airside requirements are those necessary for the operation of aircraft. Landside requirements are those necessary to support airport, aircraft and passenger operations. Proposed requirements are based on a review of existing conditions, capacity levels, activity demand forecasts and airport design standards using FAA guidance and industry standards. Existing facility deficiencies are identified along with potential future facility needs. The level of review completed is sufficient to identify major airport elements that should be addressed in this comprehensive airport plan.

Rapid City Regional Airport is a growing airport facility as a result of a continued strong demand as a result of regional tourism, health care, retail and financial sector growth and a strong Federal government presence. Since the last Master Plan, the airport has constructed various improvements including expanding passenger security screening and updating the terminal, relocating aircraft rescue and fire fighting, constructing a consolidated rental car quick turn around facility, straightening Taxiway A to correct a modification to FAA standards and expanding apron areas.

Discussions with airport management, coupled with forecasts depicting growth in all areas of aviation led to areas of emphasis in this chapter. These include identifying future commercial airline driven needs and assuring that existing users such as cargo, USFS, general aviation hangars, SDARNG, and support facilities have sufficient room to expand. Overall, airport facility development will be identified to adequately accommodate existing and expected activity levels in this Master Plan.

Potential solutions to address the facility needs through the planning period are discussed in this chapter. Specific alternatives that implement the recommendations are evaluated in **Chapter 5: Alternatives**.

Planning Activity Levels

There are various airport activity measures used to determine facility requirements including passenger enplanements, peak hour and airport operations. Airport activity can be sensitive to industry changes, national and local economic conditions. This results in difficulty in identifying a specific calendar year for the airport to each demand levels associated recommended improvements. For this Master Plan, Planning Activity Levels (PALs) are used to

identify demand thresholds for recommended facility improvements. If an activity level is approaching a PAL then the airport should prepare to implement the improvements. Alternatively, activity levels that are not approaching a PAL can allow improvements to be deferred. The forecasts developed in the last chapter are now correlated with each PAL 1, 2 3 and 4 which were 2018, 2023, 2028, and 2033 respectively.

The following Table identifies the PAL metrics for the Rapid City Regional Airport.

Table 4-1 – Planning Activity Levels (PALs)

Planning Activity Levels					
Metric	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Passengers					
Annual Enplanements	256,191	275,634	296,254	318,133	341,298
Peak Month (12.22%)	31,255	33,627	36,143	38,812	41,638
Design Day	1,031	1,110	1,193	1,281	1,374
Design Hour Departing (19.5%)	201	216	233	250	268
Design Hour Arriving (19.5%)	201	216	233	250	268
Design Hour Total Seats (14.3%)	295	317	341	366	393
Passenger Airline Operations					
Total Operations	14,016	13,700	14,079	14,491	14,623
Peak Month	1,713	1,674	1,720	1,771	1,787
Design Day	59.6	58.3	59.9	61.6	62.2
Design Hour	5.4	5.2	5.4	5.5	5.6
Total Operations					
Total Operations	41,358	43,280	46,610	50,396	54,753
Peak Month	4,214	4,410	4,750	5,135	5,579
Design Day	208	218	235	251	276
Design Hour	21	22	23	25	28

Source: KLJ Analysis

Airside Facilities

Airfield Design Standards

Guidance on airport design standards is found in FAA Advisory Circular 150/5300-13A, *Airport Design*. Change 1 to the Advisory Circular was issued February 26, 2014 and is incorporated into this chapter. Airport design standards provide basic guidelines for a safe, efficient, and economic airport system. Careful selection of basic aircraft characteristics for which the airport will be designed is important. Airport designs based only on existing aircraft can severely limit the ability to expand the airport to meet future requirements for larger, more demanding aircraft. Airport designs that are based on large aircraft unlikely to operate at the airport are not economical.

Design Aircraft

Aircraft characteristics relate directly to the design components on an airport. Planning a new airport or improvements to an existing airport requires the selection of one or more "design aircraft." FAA design standards for an airport are determined by a coding system that relates

the physical and operational characteristics of an aircraft to the design and safety separation distances of the airfield facility. The design aircraft is the most demanding aircraft operating or forecast to operate at the airport on a regular basis, which is typically considered 500 annual operations. The design aircraft may be a single aircraft, or a grouping of aircraft. It is not the usual practice to base the airport design on an aircraft that uses the airport infrequently, thus some elements may be designed for a less demanding aircraft. The FAA typically only provides funding for the airport to be designed to existing and forecasted critical aircraft that are expected to exceed 500 annual operations.

Other Design Considerations

Other airport design principles are important to consider for a safe and efficient airport design:

- Runway/Taxiway Configuration – The configuration of runways and taxiways affects the airport's capacity/delay, risk of incursions with other aircraft on the runway and overall operational safety. Airports with simultaneous operations on crossing runways can cause delay. Location of and type of taxiways connecting with runways correlates to minimizing runway occupancy time. The design of taxiway infrastructure should promote safety by minimizing confusing or complex geometry to reduce risk of an aircraft inadvertently entering the runway environment.
- Approach and Departure Airspace & Land Use – Runways have imaginary surfaces that extend upward and outward from the runway end to protect normal flight operations. Runways also have land use standards beyond the runway end to protect the flying public as well as persons and property on the ground from potential operational hazards. Runways must meet grading and clearance standards considering natural and man-made obstacles that may obstruct these airspace surfaces. Surrounding land use should be compatible with airport operations. Airports should develop comprehensive land use controls to prevent new hazards outside the airport property line. Obstructions can limit the utility of a runway.
- Meteorological Conditions – An airport's runways should be designed so that aircraft land and takeoff into the prevailing wind. As wind conditions change, the addition of an additional runway may be needed to mitigate the effects of significant crosswind conditions that occur more than five percent of the year. Airports that experience lower cloud ceiling and/or visibility should also consider implementing an instrument procedures and related navigational aids to runways to maximize airport utility.
- Controller Line of Sight – The local Airport Traffic Control Tower (ATCT) relies on a clear line of sight from the controller cab to the airport's movement areas which includes the runways, taxiways, aprons and arrival/departure corridors. Structures on an airport need to consider this design standard, and in some cases require the completion of a shadow study to demonstrate no adverse impact.
- Navigation Aids & Critical Areas – Visual navigational aids (NAVAIDs) to a runway or the airfield require necessary clear areas for these NAVAIDs to be effective for pilots. Instrument NAVAIDs on an airport require sufficient clear areas for the NAVAID to

properly function without interference to provide guidance to pilots. These NAVAID protection areas restrict development.

- Airfield Line of Sight – Runways need to meet grading standards so that objects and aircraft can be seen along the entire runway. A clear line of sight is also required for intersecting runways within the Runway Visibility Zone to allow pilots to maintain visual contact with other objects and/or aircraft that may pose a hazard.
- Interface with Landside – The airfield configuration should be designed to provide for the safe and efficient operation of aircraft as they transition from the airfield to landside facilities such as hangars and terminals.
- Environmental Factors – Airport development must consider potential impacts in and around the airport environs through the National Environmental Policy Act (NEPA). Additionally, development should also reduce the risk of potential wildlife hazards such as deer and birds that may cause hazards to flight operations.

Design Aircraft

The design aircraft types must be identified to determine the appropriate airport design standards to incorporate into airport planning. The design aircraft is the most demanding aircraft to operate at the airport at least 500 annual operations.

Operational Analysis

Existing airport operations at Rapid City in FFY 2013 were analyzed considering potential changes to the design aircraft from the aviation forecasts developed in **Chapter 3** from local and national aviation trends. **Table 2 and 3** summarize the existing Rapid City air cargo and passenger airline operations conducted by the most demanding or "critical" aircraft types based on FAA design standards.

Table 4-2 – Critical Air Cargo Operations

Critical Air Cargo Operations				
Aircraft Type	**AAC**	**ADG**	**TDG**	**2013 Operations**
Air Cargo				
ATR-42/72	B	III	2	517
Beechcraft 99	B	I	1A	126
Beechcraft 1900	B	II	2	479
Cessna 310	A	I	1A	576
Swearingen Metro III	B	II	2	702

Source: Flight Aware, KLJ Analysis

NOTE: Operations counted are on an instrument flight plan. Shaded cells represent design aircraft.

Table 4-3 – Critical Passenger Airline Operations

Critical Passenger Airline Operations				
Aircraft Type	**AAC**	**ADG**	**TDG**	**2013 Operations**
Passenger Airlines				
Airbus A319	C	III	3	268
Airbus A320	C	III	3	96
Boeing 717	C	III	3	na
Boeing 737-700	C	III	3	12
Boeing 737-800	D	III	3	23
Boeing 757-200	C	IV	4	8
Bombardier CRJ-200	D	II	2	4,555
Bombardier CRJ-700	C	II	2	8
Bombardier CRJ-900	C	II	2	26
Bombardier Q400	C	III	3	2,205
Embraer ERJ-135	C	II	2	105
Embraer ERJ-145	C	II	2	1,585
Embraer ERJ-145X	C	II	2	1,169
Embraer E170	C	III	2	130
Boeing (Douglas) MD-83	D	III	4	486
Boeing (Douglas) MD-88	D	III	4	201
Boeing (Douglas) MD-90	C	III	4	66

Source: FlightAware, KLJ Analysis
NOTE: Operations counted are on an instrument flight plan. Shaded cells represent design aircraft.

Bombardier Q-400

The most demanding aircraft for the overall airport is a Category D, Group III aircraft. The Category D aircraft that are each most heavily used at Rapid City are each scheduled by the airlines to be phased out. These are the Bombardier CRJ-200 operated by Delta, and the Boeing (Douglas) MD-83, operated by Allegiant Airlines. Since these two specific Category D aircraft are scheduled to be phased out it is recommended to work with a Category C design which there are multiple examples in the chart above. These aircraft operate on Runway 14/32.

The following Table depicts the critical general aviation aircraft operations.

Table 4-4 – Critical General Aviation Aircraft Operations

Critical General Aviation Aircraft Operations				
Aircraft Type	**AAC**	**ADG**	**TDG**	**2013 Operations**
General Aviation				
Aero Commander 690	B	I	-	169
Beechcraft King Air 90/100	B	II	1A	1,572
Beechcraft King Air 200/300	B	II	2	595
Beechcraft King Air 350	B	II	-	57
Cessna Conquest II	B	II	-	118
Cessna Citation I (501)	B	I	-	89
Cessna Citation Mustang (510)	B	I	2	55
Cessna CitationJet CJ1 (525)	B	II	2	490
Cessna Citation II (550)	B	II	2	279
Cessna Citation V (560)	B	II	2	393
Cessna Citation Excel (560XL)	B	II	2	205
Cessna Citation X (750)	C	II	1B	90
Eclipse 500	A	I	-	297
Hawker 400	B	I	-	224
Hawker 800	C	II	-	113
Learjet 31/35	C	I	-	51
Learjet 40/45	C	I	-	100
Pilatus PC-12	A	II	-	1,149
Piper Meridian	A	I	-	44
Swearingen Merlin 3	B	I	-	60
TBM 850	A	I	-	59

Source: FlightAware, KLJ Analysis
NOTE: Operations counted are on an instrument flight plan. Shaded cells represent design aircraft.

Small general aviation aircraft utilize Runway 5/23 during crosswind conditions on an occasional basis. It is used when wind conditions are limiting operations on Runway 14/32 for small aircraft.


Pilatus PC-12

The most demanding family of aircraft to use the airport are summarized in **Table 4-5.** This determination is adequate for the current classification of the airport as a C-III, TDG-4 facility.

Table 4-5 – Design Aircraft Operations

Design Aircraft Operations	
Design Component	**2013 Operations**
AAC-C	6,233
ADG-III	3,908
TDG-4	761

Source: FlightAware, KLJ Analysis

Forecast Trends

The aviation forecasts predict the overall design aircraft should be a C-III and TDG-4 representing a mix of aircraft currently and projected to serve Rapid City including the Airbus A319 operated by Allegiant Airlines, the Bombardier Q400 operated by United and the Boeing 717 operated by Delta. Passenger airline service aircraft are forecast to change in capacity with overall operations remaining steady.

Airbus A-320

As noted previously, new aircraft types are anticipated to be introduced to the airport, however, the aircraft forecast do not change the design aircraft classification throughout the planning period. The MD-83, CRJ 200 and Embraer 145 which currently serve Rapid City are planned to be phased out by the airlines in the short term. The MD-83 is being replaced by Allegiant with A319 and A320 aircraft. The CRJ 200 and Embraer 145 are each 50 passenger regional jets and all airlines serving Rapid City are upsizing their fleet to 70+ passenger aircraft as the smallest in their fleet.

Based on user input, the ATR-42 and Beechcraft 1900 turboprop aircraft are anticipated to operate more from Rapid City for air cargo operations. This aircraft has a TDG-2 classification thus operational surfaces utilized by this aircraft type should meet this standard.

General aviation aircraft of ADG-II classification are anticipated to continue utilizing the airport. These aircraft have a maximum takeoff weight of up to 36,600 pounds. A growing Rapid City business and medical community will likely contribute to increased operations over time. Future general aviation airport facilities should plan to accommodate the design standards for ADG-II airplanes to provide flexibility.

Summary

The design characteristics associated with the runways at Rapid City are summarized in the table below. Additional design aircraft information will be utilized to drive the design standards for taxiways, aprons and parking areas.

Table 4-6 – Airfield Design Aircraft Summary

Airfield Design Aircraft Summary		
Design Characteristics	**Runway 14/32**	**Runway 5/23**
Aircraft Make/Model	A319/Q400/B717	Single Engine Piston
Airplane Approach Category	C	B
Airplane Design Group	III	I (small)
Taxiway Design Group	4	1
Wingspan	117' 5"	49'
Length	124' 0"	30'
Tail Height	38' 7"	20'
Approach Speed	Up to 138 knots	Up to 121 knots
Maximum Takeoff Weight	166,000 pounds	12,500 pounds
Landing Gear Configuration	Dual Wheel	Dual Wheel
Aircraft Classification Number	65/R/C/W/T[1]	15/F/B/X/T[2]
Takeoff Runway Length*	8,550 feet	4,450 feet
Landing Runway Length*	5,800 feet	4,450 feet

Source: Boeing Airport Planning Manuals and General Aviation Aircraft evaluation, KLJ Analysis
**Runway length is for planning purposes only and varies based on operation. Figure shown is based on maximum takeoff or landing weight, wet runway (if applicable) 86.9 degrees F at Rapid City.*

Airfield Capacity

The total capacity of the airfield is the measure of the maximum number of aircraft arrivals and departures capable of being accommodated for a runway and taxiway configuration. Delay occurs when operations exceed the available capacity at an airport. Airports should plan to provide capacity enhancements well in advance to avoid undue operational delays. A master planning-level analysis was completed using the methods outlined in FAA Advisory Circular AC 150/5060-5, *Airport Capacity and Delay*.

Capacity is measured using various metrics:

- Hourly Capacity – The maximum throughput of arrivals and departures an airfield can safely accommodate in a one-hour period.
- Annual Service Volume – The maximum throughput of annual operations and airfield can safely accommodate in one-year with an acceptable level of delay.
- Aircraft Delay – The difference in time between a constrained and an unconstrained aircraft operation, measured in minutes.

Input Factors

Measuring airfield capacity is driven by many factors including aircraft fleet mix, runway use configuration, meteorological flight conditions and runway operational procedures. Each is

[1] The calculations are based on a mixture of aircraft including: MD-83 (500 Annual Departures), CRJ-200 (2,000 Annual Departures), ERJ-145 (2,500 Annual Departures) and A319/A320 (150 Annual Departures)
[2] The calculations are based on a mixture of aircraft including PC-12 (3,500 Annual Departures), Citation VI/VII (24,500 Annual Departures)

calculated to cumulatively determine the hourly capacity and annual service volume for an airport.

Aircraft Fleet Mix

Different types of aircraft operating on an airport impacts airport capacity. In addition to required arrival and departure flow separation requirements between similar aircraft types, aircraft with different speeds create the need additional spacing requirements to maintain minimum separation. Greater spacing is also required for small aircraft to avoid wake turbulence created by larger aircraft. The airport's fleet mix index is established using FAA guidelines. These classifications are provided in **Table 4-7**.

Table 4-7 – Aircraft Capacity and Delay Fleet Mix Classifications

Aircraft Capacity and Delay Fleet Mix Classifications			
Aircraft Classification	**Maximum Takeoff Weight (MTOW)**	**Number of Engines**	**Wake Turbulence**
A	<12,500 lbs.	Single	Small (S)
B		Multi	Small (S)
C	12,500 – 300,000 lbs.	Multi	Large (L)
D	>300,000	Multi	Heavy (H)

Source: FAA AC 150/5060-5, Airport Capacity and Delay

The aircraft fleet mix percentage for capacity calculations is determined by the FAA's formula (C + 3D) using aircraft fleet mix classifications. In reviewing the aviation forecasts for Rapid City, the fleet mix percentage for Instrument Flight Rules (IFR) operations and Visual Flight Rule (VFR) operations are summarized in the table below. In analyzing flight activity from 2012 through 2013, 41.5 percent of the total operations under IFR are estimated to be conducted in Class C aircraft. Operations in Class D aircraft total 0.01 percent.

Table 4-8 – Aircraft Capacity and Delay Fleet Mix Index

Aircraft (Class C & D in Table 4-7) Fleet Mix Percentage		
Metric	**Base**	**PAL 4**
IFR Fleet Mix Percentage	41.56%	41.5%
VFR Fleet Mix Percentage	6.77%	6.7%

Source: FAA AC 150/5060-5, Airport Capacity and Delay, KLJ Analysis

Runway Use

The runway use configuration affects the operational efficiency and capacity of an airfield. An independent runway is one that can be operational and not affect arrivals and/or departures from other runways. A dependent runway is directly affected by the operations of another runway. Operations from another runway must be clear so operations on the other runway can safely occur. This dependent runway configuration increases wait time, reduces capacity and can increase overall delay. This is commonly seen for airfields with crossing runways.

At Rapid City, Runway 14/32 and 5/23 intersect at the north westerly portion of each runways total length. See **Exhibit 4-1 Runway Use Configuration**. Both of these runways can handle VFR and IFR operations, arrivals and departures. The estimated runway end utilization is identified in the table below.

Table 4-9 – Runway Utilization

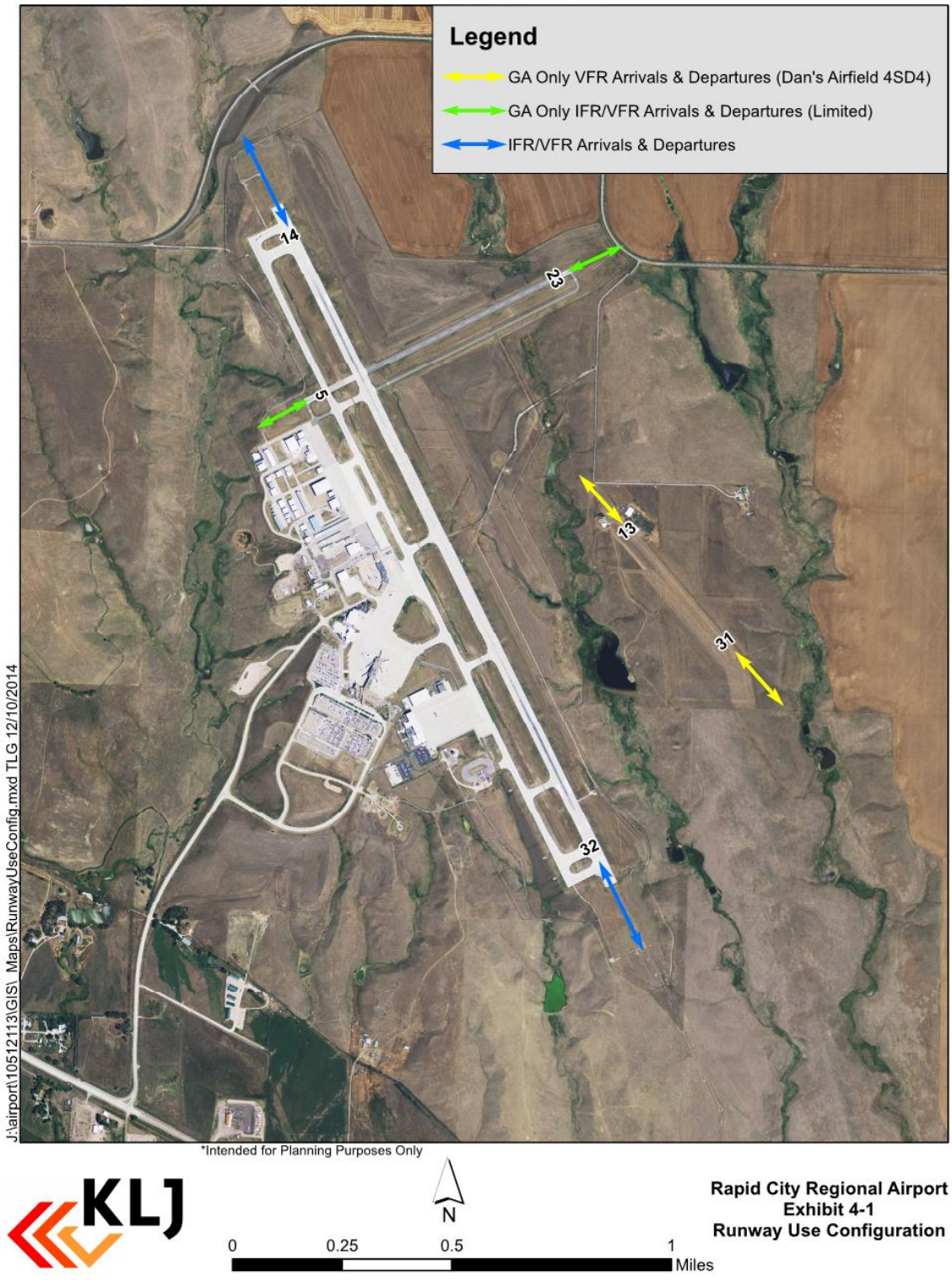
Runway Utilization		
Runway End	**End Utilization**	**Runway Utilization**
14	34.9%	97.0%
32	62.1%	
5	2.0%	3.0%
23	1.0%	

Source: KLJ Analysis (estimate) and ATCT Feedback

Based on weather observations and operational patterns, it is assumed a single runway scenario occurs 95.9 percent of the time during VFR conditions and 93.0 percent of the time during IFR conditions. Runway 5/23 is used periodically during high wind conditions as a general aviation runway.

A unique element with Rapid City is the existence of Dan's Airfield (FAA Identifier 4SD4) which is approximately 2,000 feet east of the airport with a runway 13/31 generally parallel but converging to Rapid City's primary runway. The ATCT staff advised that Dan's Airfield is not used often but when it is used the activity at Dan's Airfield Runway 13/31 and Rapid City's Runway 14/32 are treated as one runway to avoid conflicts.

Exhibit 4-1 – Runway Use Configuration



Source: KLJ Analysis

Other Considerations

Meteorological conditions are a consideration for capacity calculations. An analysis of the weather observations over the past 10 years show VFR conditions are experienced 86.77 percent of the time, IFR conditions within the capability of current approach minimums experienced 10.23 percent, and IFR conditions below current instrument approach minimums occurring 3.00 percent of the time.

The number and location of exit taxiways were considered. Ideally spaced exit taxiways allow aircraft to expediently leave the runway environment upon landing, thus increasing airfield capacity. Each assumes an average of two exit taxiways spaced between 3,500 and 6,500 feet from the landing threshold spaced at least 750 feet apart for VFR operations and one exit taxiway between 5,000 and 7,000 feet for IFR operations. FAA determines the exit factor to range from 0.86 to 0.97, depending on runway configuration and weather conditions.

Touch and go operation are those that land then takeoff on the same runway without exiting the runway. These typically occur with small training aircraft and counts for two operations, thus increasing airfield capacity. There is not an unusually higher percentage of touch-and-go operations at Rapid City as a result of flight training operations, thus a standard 1.00 exit factor was applied for capacity calculations.

A weighting factor is also applied per FAA guidance ranging from 1 to 25 for determining weighted hourly capacity. Arrivals are assumed to be 50 percent of total operations. Additional arrivals causes capacity to decrease due to separation requirements.

Hourly Capacity

Hourly capacity is calculated during IFR and VFR conditions using an FAA recommended equation based on runway configuration, touch-and-go and taxiway exit factors. Weighted hourly capacity is determined based on runway utilization, weather conditions and an FAA weighting factor. The results for the base and PAL 4 scenarios are identified below. Assuming no change to the airfield configuration, the results are similar for the base through PAL 4 due to a minimal change in fleet mix.

Table 4-10 - Hourly Capacity

Hourly Capacity	
Factors	**Base, PAL 1-4 Fleet Mix**
Single Runway Use Scenario	
VFR Hourly Capacity	74
IFR Hourly Capacity	57

Source: FAA AC 150/5060-5, Airport Capacity and Delay, KLJ Analysis

Annual Service Volume

Annual Service Volume (ASV) is an estimate of the total annual aircraft operations on an airfield annually. ASV is calculated based on the weighted hourly capacity multiplied by hourly and daily demand ratios. The ratio of the total operations to an airport's ASV determines if and when an airport should plan for capacity improvements to increase overall capacity. For Rapid City, the IFR Hourly Capacity was the most restrictive resulting in an

Annual Service Volume of 195,000 operations which was therefore used to determine the airport's capacity level.

Table 4-11 – Annual Service Volume (ASV)

Annual Service Volume (ASV)					
Metric	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Annual Operations	41,358	43,280	46,610	50,396	54,753
Average Design Day	208	218	235	254	276
Average Design Hour	21	22	23	25	28
Annual Service Volume	195,000	195,000	195,000	195,000	195,000
Capacity Level	**21.2%**	**22.2%**	**23.9%**	**25.8%**	**28.1%**

Source: FAA AC 150/5060-5, Airport Capacity and Delay, KLJ Analysis

FAA recommends airports take action to implement capacity enhancement projects when an airport has reached 60 percent of its annual capacity. Rapid City Regional Airport is not projected to be near 60% within the planning period.

Aircraft Delay

Aircraft delay exists because of local weather and operational conditions and cannot be entirely eliminated. Delay is measured in minutes per aircraft and hours per year. The FAA's assumptions identified in *Advisory Circular 150/5060-5, Airport Capacity and Delay* are used to identify delay measures and estimated cost. A four-to-six minute delay per aircraft is considered acceptable for normal airport operations. Delay consistently approaching 10 to 15 minutes per aircraft is a trigger for a new capacity-driven runway. Delay at Rapid City Regional Airport on average does not approach these thresholds. Delay is considered acceptable for operations into the planning period.

Summary

The purpose of this review is to provide a master planning-level review of airport capacity for long-range planning. A review of the capacity assumptions is recommended at or before that level as operational patterns may change over time. If the capacity ratio of 60 percent is reached, enhancements should be programmed into the capital improvement plan to enhance capacity, and reduce delay. Example improvements may include additional taxiway turnoffs or high-speed exits.

Meteorological Considerations

Meteorological conditions that affect the facility requirements of an airport include wind coverage and weather condition encountered. Metrological data at Rapid City were reviewed using that past 10 years of data from the Rapid City Regional Airport AWOS facility from April 2004 through March 2014, available from the National Climatic Data Center (NCDC). This provides a comprehensive look into the average weather trends at an airport.

Wind coverage and weather conditions are evaluated based on the two different flight rules, VFR and IFR. Visual Meteorological Conditions (VMC) are encountered when the visibility is 3 nautical miles or greater, and the cloud ceiling height is 1,000 feet or greater. Conditions less

than these weather minimums are considered Instrument Meteorological Conditions (IMC) requiring all flights to be operated under IFR.

Wind Coverage

Wind coverage is important to airfield configuration and utilization. Aircraft ideally takeoff and land into headwinds alighted with the runway orientation. Aircraft are also designed and pilots are trained to land aircraft during crosswind conditions but there are limitations. Small, light aircraft are most affected by crosswinds. To mitigate the effect of crosswinds, runways on an airport are aligned so that they meet a minimum of 95 percent wind coverage where crosswind conditions are encountered 5 percent of the time or less. Each aircraft's AAC-ADG combination corresponds to a maximum crosswind wind speed component.

Table 4-12 – Wind Coverage Requirements

Wind Coverage Requirements	
AAC-ADG	**Maximum Crosswind Component**
A-I & B-I	10.5 knots
A-II & B-II	13.0 knots
A-III, B-III, C-I through D-III	16.0 knots
A-IV through D-VI	20.0 knots

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

Wind coverage for the airport is separated into all-weather (VMC and IMC) and IMC alone. All-weather analysis helps determine runway orientation and use. Local weather patterns commonly change in IMC. An IMC review helps determine the runway configuration for establishing instrument approaches.

Table 4-13 – All-Weather Wind Analysis

All-Weather Wind Analysis					
Runway	**AAC-ADG**	**Crosswind Component (Wind Speed)**			
		10.5 knots	**13.0 knots**	**16.0 knots**	**20.0 knots**
Runway 14/32	C-III	95.97%	98.16%	99.40%	99.82%
Runway 5/23	B-I	70.18%	77.24%	-	-
Combined*	**-**	**98.22%**	**99.47%**	**99.40%**	**99.82%**

**Combined assumes up to maximum design aircraft crosswind component for each runway*
Source: National Climatic Data Center data from Rapid City Regional Airport ASOS (2004-2014)

The design aircraft (able to use the runway with a 16.0 knot crosswind component) is accommodated on Runway 14/32 during all-weather conditions with airfield wind coverage exceeding 95 percent. For small aircraft that have a 10.5 knot crosswind threshold, these airplanes can be accommodated 98.22 percent of the time with the current two-runway configuration.

Table 4-14 – IFR Wind Analysis

IFR Wind Analysis					
Runway	AAC-ADG	Crosswind Component (Wind Speed)			
		10.5 knots	13.0 knots	16.0 knots	20.0 knots
Runway 14/32	C-III	93.06%	97.00%	99.16%	99.77%
Runway 5/23	B-I	64.33%	71.65%	-	-
Combined*	-	**96.58%**	**98.81%**	**99.16%**	**99.77%**

**Combined assumes up to maximum design aircraft crosswind component for each runway*
Source: National Climatic Data Center data from Rapid City Regional Airport ASOS (2003-2012)

The design aircraft is accommodated on Runway 14/32 during IFR with airfield wind coverage exceeding 95 percent. For small aircraft that have a 10.5 knot crosswind threshold, these airplanes can be accommodated 96.58 percent of the time with the current two-runway configuration.

When analyzed by runway end, Runway 32 is the preferred end by wind direction for IMC operations, followed by 05, 14 then 23. The lowest published instrument approach minimums are available on Runway 32 followed by Runway 14. It is recommended to take steps to lower approach minimums to Runway 14 to maximize airfield utilization. It is not recommended to lower the minimums for Runway 05 because it was found that the favorable coverage that Runway 05 has is due to a large portion of winds favoring between 360° and 030° which are counted as acceptable for both Runways 05 and 32.

Table 4-15 – IFR Wind Analysis by Runway End

IFR Wind Analysis by Runway End					
Runway End	AAC-ADG	Crosswind Component (Wind Speed)			
		10.5 knots	13.0 knots	16.0 knots	20.0 knots
Runway 14	C-III	38.48%	39.18%	39.72%	39.87%
Runway 32	C-III	63.16%	66.40%	68.02%	68.47%
Runway 5	B-I	55.45%	61.95%	68.48%	74.00%
Runway 23	B-I	17.46%	18.27%	19.36%	20.27%

Source: National Climatic Data Center data from Rapid City Regional Airport ASOS (2004-2014)

Weather Conditions

When reduced visibility weather conditions occur, aircraft must operate under IFR and utilize instrument approach procedures to an airfield. These IFR conditions drive the need to accommodate instrument approach procedures with sufficient weather minimums to continue airport operation and increase utilization.

Weather conditions are broken down into occurrence percentages based on instrument approach minimums in the following table.

Table 4-16 – Meteorological Analysis

Meteorological Analysis			
Weather Condition	**Cloud Ceiling Minimum**	**Visibility Minimum**	**Observation Percentage**
Visual Flight Rules (VFR)	3,000 feet	5 miles	79.20%
Marginal Visual Flight Rules (MVFR)	1,000 feet	3 miles	7.57%
Instrument Flight Rules (IFR)	600 feet	1 mile	6.59%
Instrument Flight Rules (IFR) Category I	200 feet	½ mile	3.64%
Instrument Flight Rules IFR Category II	100 feet	¼ mile	0.59%
IFR Category III & Below	0 feet	$^{1}/_{8}$ mile	2.41%
TOTAL			100.00%

Source: National Climatic Data Center data from Rapid City Regional Airport ASOS (2004-2014)

Average high temperature data for the hottest month was reviewed from climate summaries available from the National Weather Service for Rapid City. The average high temperature in the hottest month from 2004-2013 was 86.9 degrees Fahrenheit.

Runways

Rapid City has two runways, one air carrier runway and one general aviation runway. Runway 14/32 is the longest runway at 8,701 feet long and 150 feet wide. This runway is currently designed to accommodate precision approaches with lowest precision instrument approach minimums on the airfield of ½ mile (2400 RVR). Runway 5/23 is a secondary runway used by general aviation aircraft which are 12,500 pounds and under. This runway is 3,601 feet long by 75 feet wide with non-precision instrument approaches with visibility minimums as low as 1 mile.

Runway Design Code

The existing design aircraft identifies the RDC for Runway 14/32 as C/III/2400 (½ mile). The RDC for Runway 5/23 is A/I/5000 accommodating small aircraft exclusively. These are recommended to remain through the future as C/III/2400 and A/I/5000 respectively.

Design Standards

One primary purpose of this master plan is to review and achieve compliance with all FAA safety and design standards. The design standards vary based on the RDC and RRC as established by the design aircraft. In addition to the runway pavement width, some of the safety standards include:

- Runway Safety Area (RSA) – A defined graded surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot or excursion from the runway. The RSA must be free of objects, except those required to be located in the RSA to serve their function. The RSA should also be capable to supporting airport equipment and the occasional passage of aircraft.
- Runway Object Free Area (ROFA) – An area centered on the ground on a runway provided to enhance the safety of aircraft operations by remaining clear of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

- Runway Obstacle Free Zone (ROFZ) – The OFZ is the three-dimensional volume of airspace along the runway and extended runway centerline that is required to be clear of taxiing or parked aircraft as well as other obstacles that do not need to be within the OFZ to function. The purpose of the OFZ is for protection of aircraft landing or taking off from the runway and for missed approaches.

Other design standards include runway shoulder width to prevent soil erosion or debris ingestion for jet engines, blast pad to prevent soil erosion from jet blast, and required separation distances from objects and other infrastructure for safety. Critical areas associated with navigational aids as well as airspace requirements are described further in this chapter.

Runway Protection Zone

The Runway Protection Zone (RPZ) is a trapezoidal land use area at ground level prior to the threshold or beyond the runway end to enhance the safety and protection of people and property on the ground. The land within the RPZ should be under airport control and cleared of incompatible land uses. FAA issued an interim policy on activities within an RPZ on September 27, 2012. Currently there is a public road, Long View Road, within the approach RPZ to Runway 14 and the RPZ to Runway 23.

New development discouraged within the RPZ includes new roads, structures and places of public assembly. New development within an RPZ or new RPZ size/location of an RPZ is subject to FAA review on a case-by-case basis to reduce risk to people on the ground. Mitigation tactics for new or existing land uses may include removal/relocation of the object or modifying usable runway length (declared distances) to relocate the RPZ outside of the land use. Tables identifying the runway design standards follow.

Table 4-17 – Runway 14/32 FAA Design Standard Matrix

Runway 14/32 FAA Design Standard Matrix			
Design Standard	**Actual**	**Runway Design Code (RDC)**	
		C/III/2400 (Future)	**C/III/2400 (Ultimate)**
Approach Reference Code	C/III/2400	C/III/2400	C/III/2400
Departure Reference Code	C-III	C-III	C-III
Runway Width	150 feet	150 feet	150 feet
Shoulder Width	0 feet	25 feet	25 feet
Blast Pad Width	200' – RW 14 150' – RW 32	200 feet	200 feet
Blast Pad Length	200 feet	200 feet	200 feet
Line of Sight Requirements	No Objects	No Objects	No Objects
RSA Width	500 feet	500 feet	500 feet
RSA Length Past Departure End	1,000 feet	1,000 feet	1,000 feet
RSA Length Prior to Threshold	600 feet	600 feet	600 feet
ROFA Width	800 feet	800 feet	800 feet
ROFA Length Past Departure End	1,000 feet	1,000 feet	1,000 feet
ROFA Length Prior to Threshold	600 feet	600 feet	600 feet
ROFZ Length Past Runway	200 feet	200 feet	200 feet
ROFZ Width	400 feet	400 feet	400 feet
Inner Approach OFZ	N/A	50:1 Slope	50:1 Slope
Inner Transitional OFZ	N/A	Varies	Varies
Precision ROFZ Length	200' RW 32	200 feet	200 feet
Precision ROFZ Width	800' RW 32	800 feet	800 feet
Approach RPZ Start from Runway	200 feet	200 feet	200 feet
Approach RPZ Length	1,700' RW 14 2,500' RW 32	2,500 feet	2,500 feet
Approach RPZ Inner Width	500' RW 14 1,000' RW 32	1,000 feet	1,000 feet
Approach RPZ Outer Width	1,010' RW 14 1,750' RW 32	1,750 feet	1,750 feet
Departure RPZ Start from Runway	200 feet	200 feet	200 feet
Departure RPZ Length	1,700 feet	1,700 feet	1,700 feet
Departure RPZ Inner Width	500 feet	500 feet	500 feet
Departure RPZ Outer Width	1,010 feet	1,010 feet	1,010 feet
Runway Centerline to Parallel Taxiway Centerline	450 feet	400 feet	400 feet
Runway Centerline to Edge of Aircraft Parking	570 feet	500 feet	500 feet
Runway Centerline to Hold Line	250 feet	250 feet	250 feet

Note: RED indicates a deficiency to existing design standards
Source: FAA AC 150/5300-13A Airport Design, KLJ Analysis

Table 4-18 – Runway 5/23 FAA Design Standard Matrix

Runway 5/23 FAA Design Standard Matrix		
Design Standard	**Actual**	**Runway Design Code (RDC)**
		B/I/5000 – Small Aircraft (Existing & Future)
Approach Reference Code	B-I Small	B-I Small
Departure Reference Code	B-I	B-I
Runway Width	75 feet	60 feet
Shoulder Width	0 feet*	0 feet*
Blast Pad Width	0 feet*	0 feet*
Blast Pad Length	0 feet*	0 feet*
Line of Sight Requirements	No Objects	No Objects
RSA Width	150 feet	120 feet
RSA Length Past Departure End	300 feet	240 feet
RSA Length Prior to Threshold	300 feet	240 feet
ROFA Width	500 feet	250 feet
ROFA Length Past Departure End	300 feet	240 feet
ROFA Length Prior to Threshold	300 feet	240 feet
ROFZ Length Past Runway	200 feet	200 feet
ROFZ Width	250 feet	250 feet
Inner Approach OFZ	N/A	N/A
Inner Transitional OFZ	N/A	N/A
Precision ROFZ Length	N/A	N/A
Precision ROFZ Width	N/A	N/A
Approach RPZ Start from Runway	200 feet	200 feet
Approach RPZ Length	1,000 feet	1,000 feet
Approach RPZ Inner Width	250 feet	250 feet
Approach RPZ Outer Width	450 feet	450 feet
Departure RPZ Start from Runway	200 feet	200 feet
Departure RPZ Length	1,000 feet	1,000 feet
Departure RPZ Inner Width	250 feet	250 feet
Departure RPZ Outer Width	450 feet	450 feet
Runway Centerline to Parallel Taxiway Centerline	250 feet	150 feet
Runway Centerline to Edge of Aircraft Parking	300 feet	125 feet
Runway Centerline to Hold Line	125 feet	125 feet

Note: RED indicates a deficiency to existing design standards
**Not required for aircraft operations type and RDC*
Source: FAA AC 150/5300-13A Airport Design, KLJ Analysis

Recommendations

Runway improvement recommendations are as follows:

- **Construct 25 foot paved shoulders for Runway 14/32.**
- **Expand the Blast Pad width for Runway 32.**
- **Expand the Runway Protection Zone for Runway 14.**
- **While this was not identified in this section, it was determined in the site visit that there is a hill area which is currently obstructing the view of aircraft on Runway 23 from being seen by the Airport Traffic Control Tower. This hill should be removed.**

Legend

- Existing Airport Property
- Object Free Area
- Object Free Zone
- Precision Object Free Zone
- Runway Protection Zone
- Runway Safety Area
- Runway Visibility Zone

Existing Runway Design Code:
Runway 14/32: C/III/2400
Runway 5/23: A/I/5000 Small Aircraft

Runway Design Standard Deficiencies
1. No Runway Shoulder (14/32)
2. Substandard Blast Pad
3. Road within Future RPZ
4. Objects in Approach Surface for Future Precision Instrument Approach

N

0 1,000 2,000 4,000 Feet

*Intended for Planning Purposes Only

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Rapid City Regional Airport
Runway Design Standards
Exhibit 4-2

Runway Length

The recommended runway length for an airport facility varies widely based on runway usage (number of operations per year), specific aircraft operational demands (aircraft type, weight/load) and local meteorological conditions (elevation, temperatures). Runway length should be suitable for the forecasted critical design aircraft.

Design Aircraft

A runway length analysis was performed using the manufacturer's Aircraft Planning Manuals and other available performance data. Sufficient runway length is important for the airport to maintain operational capability. It allows an aircraft operator to adequately serve their destinations. Restrictions on runway length may lead to reduced weight on a flight, which then translates into reduced fuel, passenger and/or cargo loads. The design approach identified in FAA Advisory Circular AC 150/5325-4B, *Runway Length Requirements for Airport Design* was used to determine runway length calculations for Rapid City.

It is very important to adequately plan for a future runway configuration as these projects tend to effect the community beyond the property line. Projects of these magnitude require many resources and long lead times for planning, environmental review and funding allocation.

A summary of the runway length requirements for various design aircraft types is outlined in the following Tables.

Table 4-19 – Design Aircraft Runway Length Requirements (Zero Gradient)

DESIGN AIRCRAFT ANALYSIS
Zero Runway Gradient Adjustment

Airlines/Hubs		Distance (NM)	Aircraft and Engines											
			CRJ200	CRJ700	CRJ900	Q400	E145	E175	MD83	A319	A320	B717	B737-800	B757-200
		Engine	CF34-3B1	CF34-8C5B1	CF34-8C5	PW 150A	AE 3007-A1E	CF34-8E5	JT8D-219	CFM56-5B5/3	CFM56	BR715-A1-30	CFM56-7	PW 2037
		Maximum Takeoff Weight (lbs)	53,000	72,250	80,500	64,500	53,131	82,673	160,000	166,449	171,961	121,000	174,200	255,000
		Runway Design Code (RDC)	D-II	C-II	C-III	C-III	C-II	C-III	D-III	C-III	C-III	C-III	D-III	C-IV
		Taxiway Design Group (TDG)	3	3	3	3	3	3	4	3	3	3	3	4
			Runway Length (FT)											
United	DEN	260	6,900			5,700	5,700	5,000						
Delta	MSP	425	6,900	5,700	6,600					7,200		6,300	6,200	5,500
Delta	SLC	440	6,900	5,700	6,600							6,500		
American	ORD	675	7,000		7,400		6,300	5,200						
United	ORD	675	7,000				6,300	5,200						
American	DFW	725	7,200		7,500		6,400	5,300						
Allegiant	LAS	730							7,500	7,200	7,000			
Allegiant	IWA	760							7,500	7,200	7,000			
Alaska	SEA	830											6,800	
United	IAH	920					6,800	5,500						
Delta	ATL	1,070		6,600	7,700							7,300		
Allegiant	SFB	1,390							8,800	7,200	7,000			

FAA A/C 150/5325 - 4B Runway Length: 75% of Fleet (up to 60,000lb MTOW) at 90% Useful Load, Length =	8,050
FAA A/C 150/5325 - 4B Runway Length: 100% of Fleet (up to 60,000lb MTOW) at 90% Useful Load, Length =	9,150

- Runway lengths calculated based on specific aircraft manufacturer's manuals for ISA +15C temperatures
- Mean daily high temperature of 87 degrees F
- Runway difference in center line elevations N/A *Runway Gradient Adjustment* *0* *feet*
- Elevation 3,204 MSL

Table 4-20 – Design Aircraft Runway Length Requirements (49 Feet Gradient)

DESIGN AIRCRAFT ANALYSIS

Adjusted for Runway Gradient: Maximum Difference between Runway Centerline Elevations 49' = 500' Takeoff Length Extension

			Aircraft and Engines											
			CRJ200	CRJ700	CRJ900	Q400	E145	E175	MD83	A319	A320	B717	B737-800	B757-200
		Engine	CF34-3B1	CF34-8C5B1	CF34-8C5	PW 150A	AE 3007-A1E	CF34-8E5	JT8D-219	CFM56-5B5/3	CFM56	BR715-A1-30	CFM56-7	PW 2037
		Maximum Takeoff Weight (lbs)	53,000	72,250	80,500	64,500	53,131	82,673	160,000	166,449	171,961	121,000	174,200	255,000
		Runway Design Code (RDC)	D-II	C-II	C-III	C-III	C-II	C-III	D-III	C-III	C-III	C-III	D-III	C-IV
		Taxiway Design Group (TDG)	3	3	3	3	3	3	4	3	3	3	3	4
Airlines/Hubs		Distance (NM)	Runway Length (FT)											
United	DEN	260	7,400			6,200	6,200	5,500						
Delta	MSP	425	7,400	6,200	7,100					7,700		6,800	6,700	6,000
Delta	SLC	440	7,400	6,200	7,100									
American	ORD	675	7,500		7,900		6,800	5,700						
United	ORD	675	7,500				6,800	5,700						
American	DFW	725	7,700		8,000		6,900	5,800						
Allegiant	LAS	730							8,000	7,700	7,500			
Allegiant	IWA	760							8,000	7,700	7,500			
Alaska	SEA	830											7,300	
United	IAH	920					7,300	6,000						
Delta	ATL	1,070		7,100	8,200							7,800		
Allegiant	SFB	1,390							9,300	7,700	7,500			

FAA A/C 150/5325 - 4B Runway Length: 75% of Fleet (up to 60,000lb MTOW) at 90% Useful Load, Length =	8,550
FAA A/C 150/5325 - 4B Runway Length: 100% of Fleet (up to 60,000lb MTOW) at 90% Useful Load, Length =	9,650

- Runway lengths calculated based on specific aircraft manufacturer's manuals for ISA +15C temperatures
- Mean daily high temperature of 87 degrees F
- Runway difference in center line elevations 49 feet *Runway Gradient Adjustment* *500* *feet*
- Elevation 3,204 MSL

Not all aircraft are operated at maximum takeoff weight at Rapid City. During hot summer days, a few operators are weight limited by the existing 8,701 foot runway length. Takeoff weight is restricted for CRJ200's and MD-83s when the temperature reaches 85 degrees Fahrenheit. For the CRJ200's this is for destinations in Denver, Dallas/Fort Worth and Minneapolis and the MD-83 this is for Allegiant to Las Vegas and Mesa. New aircraft types are expected to have more efficient engines and improved takeoff performance. While the existing length is sufficient for current and forecasted operations there are trigger points which could require a longer runway. These trigger points, which will require 500 annual operations of this activity are identified below:

- International/Further Domestic Destinations – in order to fly non-stop to most international destinations or further domestic destinations a longer runway would be required. The furthest scheduled destination for Rapid City is Atlanta at 1,070 nautical miles. The amount of runway length required will be dependent upon the aircraft type.
- Continuation of MD-83, CRJ200 or similar aircraft to further distances – the MD-83 and CRJ200 are aircraft that require a longer runway than other aircraft serving Rapid City. If aircraft like these serve Rapid City to further destinations, then a longer runway will be required so that the aircraft can operate fully loaded. For example the MD-83 from Rapid City to Orlando Sanford at 1,390 nautical miles, would require 9,300 feet in runway length.

Aircraft Less Than 60,000 Pounds

A runway length analysis for other aircraft was performed using the FAA's methodology found in FAA Advisory Circular AC 150/5325-4B, *Runway Length Requirements for Airport Design*. These aircraft include business jets and other general aviation aircraft for identifying the recommended runway length for secondary runways accommodating aircraft less than 60,000 pounds. The FAA recommended runway length calculations for Rapid City are summarized in the following table:

Table 4-21 – FAA Runway Length Requirements

FAA Runway Length Requirements	
Airport and Runway Data	
Airport Elevation	3,204 feet
Mean Daily Maximum Temperature of Hottest Month	86.9°F
Maximum Difference in Runway Centerline Elevation	49 feet
Runway Condition	Wet and Slippery Runways
Aircraft Classification	**Recommended Runway Length**
Large airplanes less than 60,000 lbs. but greater than 12,500 lbs.	
100 percent of fleet at 90 percent useful load	9,650 feet
100 percent of fleet at 60 percent useful load	7,500 feet
75 percent of fleet at 90 percent useful load	8,550 feet
75 percent of fleet at 60 percent useful load	6,200 feet
Small airplanes 12,500 lbs. or less	
10 or more passenger seats	5,200 feet
Less than 10 passenger seats at 100 percent of fleet	5,200 feet
Less than 10 passenger seats at 95 percent of fleet	4,450 feet

Note: Runway length requirements estimated based on charts for airport planning purposes only.
Source: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design

The existing length of 8,701 feet is sufficient for Runway 14/32 to handle the vast majority of departures from Rapid City. The runway is sufficient for operations in aircraft greater than 60,000 pounds, and most aircraft less than 60,000 pounds at 100 percent of fleet aircraft with 90 percent useful load. Local wind conditions allow this runway to accommodate business jet aircraft over 96 percent. Common mid-sized business jets that operate at Rapid City include the Cessna Citation 560/750 and Hawker 800 aircraft. High load factors are common for aircraft that require passengers and cargo to be transported to destinations located thousands of miles away. These operations are common at an airport such as Rapid City.

The design aircraft for Runway 5/23 is a Single Engine Piston aircraft. While the ideal runway length is 4,650 feet, the runway is not recommended to be lengthened due to the high construction costs associated with a 1,000 foot extension coupled with the low frequency of use.

Pavement Strength

Airfield pavements should be adequately maintained, rehabilitated and reconstructed to meet the operational needs of the airport. Typical airport pavements have a 20-year design life. The published pavement strength is based on the construction materials, thickness, aircraft weight, gear configuration and operational frequency for the pavement to perform over its useful life. Larger aircraft could exceed the pavement strength but not on a regular basis.

The new FAA standard for measuring the reporting pavement strength is defined in Advisory Circular 150/5335-5B, *Standard Method of Reporting Airport Pavement Strength*. The Aircraft Classification Number – Pavement Classification Number (ACN-PCN) method is defined within this guidance. The PCN value must equal or exceed the ACN value assigned for the design

aircraft. Public-use primary airports must report PCN figures by August 2014 to be eligible for federal funding. An ACN-PCN analysis for Runway 14/32 and Runway 5/23 for Rapid City was completed in 2010.

The pavement strength for Runway 14/32 should be sufficient to accommodate regular use by the design aircraft. The design aircraft for pavement strength calculations is the MD-83 with an Aircraft Classification Number (ACN) of 53 and the A320 with an ACN of 51. The calculated Pavement Classification Number (PCN) of the runway is 65, thus no increases to pavement strength are necessary through the planning period. Runway 5/23 should be maintained to accommodate small aircraft of 12,500 pounds or less maximum takeoff weight.

Table 4-22 – Pavement Strength Requirements

Pavement Strength Requirements				
Runway	Existing		Future Need	
	Capacity	PCN	Capacity	PCN
Runway 14/32	140,000 lbs. - SW	65/R/C/W/T[3]	140,000 lbs. - SW	65/R/C/W/T
	190,000 lbs. - DW		190,000 lbs. – DW	
	300,000 lbs. - DT		300,000 lbs. - DT	
Runway 5/23	12,500 lbs. – SW	15/F/C/X/T[4]	12,500 lbs. - SW	15/F/C/X/T

SW = Single Wheel, DW = Dual Wheel, DT = Dual Tandem landing gear configuration
Source: RAP Airport Master Record (FAA Form 5010-1), KLJ Analysis

Instrument Procedures

Instrument approach procedures to a runway end are used by landing aircraft to navigate to the airport during low visibility weather when cloud ceiling is 1,000 feet of less and/or visibility is 3 miles or less. Establishing approaches with the lowest possible weather minimums allow the airport to maximize its operational capability. Each approach type requires differing infrastructure and navigational aids. Approaches with lower visibility minimums typically have additional infrastructure and navigational aids requirements. Types of approach procedures include non-precision approach (NPA), approach with vertical guidance (APV) and precision approach (PA).

As of May 2014, Rapid City has a Category I Instrument Landing System (ILS) established for Runway 32 with a 200-foot cloud ceiling minimum. The runways 14, 5 and 23 have non-precision RNAV (GPS) approach (APV) with the lowest design visibility minimums of 1 mile.

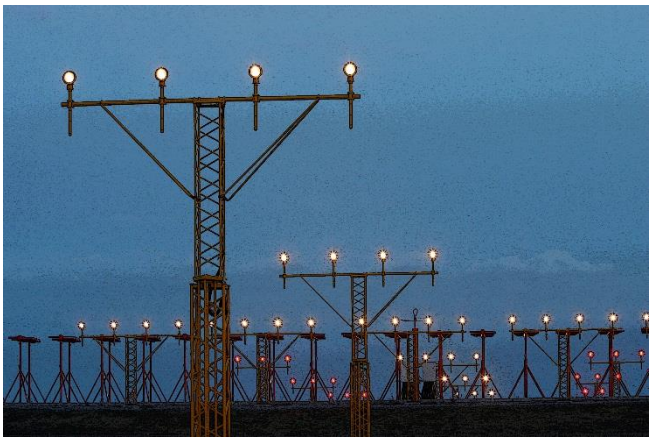
The existing approach procedures are considered adequate for the current facility. The goal for an airport is to enhance its approach procedures to increase its operational capability. At Rapid City, these include upgrading Runway 14 to accommodate a Category I ILS.

[3] The calculations are based on a mixture of aircraft including: MD-83 (500 Annual Departures), CRJ-200 (2,000 Annual Departures), ERJ-145 (2,500 Annual Departures) and A319/A320 (150 Annual Departures)
[4] The calculations are based on a mixture of aircraft including PC-12 (3,500 Annual Departures), Citation VI/VII (24,500 Annual Departures)

Upgraded Runway 14 Approach

As of May 2014, Runway 14 is served by an approach procedure with vertical guidance (LPV). The weather minimums are 300 foot cloud ceiling and 1 mile visibility for Runway 14. An approach with visibility minimums of no lower than ½ mile will trigger the following requirements:

- The FAA airport design approach surface is widened to 800 feet inner width expanding upward and outward at a 34:1 slope.
- The 14 CFR Part 77 Primary Surface expands from 250 feet to 500 feet wide centered on runway centerline. New development that penetrates this or its related 7:1 transitional surface is discouraged.
- The 14 CFR Part 77 Approach Surface is widened and the slope is lowered to 50:1.
- Approach Runway Protection Zone (RPZ) expands to 2,500 feet long, 1,000 feet wide inner width and 1,750 feet for the outer width.
- Typically requires a Category I Instrument Landing System which includes two ground based electronic aids, a localizer antenna and a glide slope antenna. However an RNAV (GPS) approach can be achieved now without the typical ILS ground based electronic equipment.
- An approach lighting system is required to achieve ½ mile visibility minimums. An example is a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) which extends 2,400 feet from the runway end.
- A 200-foot long by 800-foot wide Precision Obstacle Free Zone (OFZ) is required at the runway end.
- Typical lowest cloud ceiling is 200 feet depending on obstructions.
- Precision approach runway markings.



Recommendations

Instrument procedure recommendations include the following:

- **Maintain or remove any obstructions from existing approaches to maintain or improvement current minimums.**
- **Remove hillside near the approach to Runway 14 that penetrates into the protective surfaces and place material in areas to allow for hangar development.**
- **Relocate Long View Road to be outside of the expanded RPZ.**
- **Plan to install a MALSR system for Runway 14 to lower the existing RNAV (GPS) minimums.**
- **Plan to upgrade Runway 14 to a Category I ILS approach.**

Airspace Protection

Airspace is an important resource around airports that is very essential for safe flight operations. There are established standards to identify airspace obstructions around airports. FAA grant assurances (obligations) require the airport sponsor to take appropriate action to assure that airspace is adequately cleared to protect instrument and visual flight operations by removing, lowering, relocating, marking or lighting, or otherwise mitigating existing airport hazards and preventing the establishment or creating of future airport hazards. Sufficiently clear airspace near the approach and departure ends and along extended centerline are vitally important for safe airport operations.

An obstruction analysis is currently underway to identify obstructions to Part 77 and other airspace surfaces. The results of this analysis will be identified in the Airport Layout Plan drawing set.

Area Airspace

The airspace classification including and within 5 nautical miles of Rapid City is Class D controlled airspace. The Airport Traffic Control Tower (ATCT) safely and efficiently handles all operations within this airspace. Ellsworth Air Force Base, 5 miles north of Rapid City Regional Airport is also in Class D airspace and operates 24 hours a day Monday through Friday providing approach/departure control for Rapid City Regional Airport. On weekends the approach/departure control is provided by Denver ARTCC.

Part 77 Civil Airport Imaginary Surfaces

Title 14 CFR (Code of Federal Regulations) Part 77 *Safe, Efficient Use, and Preservation of the Navigable Airspace* is used to determine whether man-made or natural objects penetrate these "imaginary" three-dimensional airspace surfaces and become obstructions. Federal Aviation Regulation (FAR) Part 77 surfaces are the protective surfaces most often used to provide height restriction zoning protection around an airport. Sufficiently clear airspace is necessary for the safe and efficient use of aircraft arriving and departing an airport. Part 77 airspace standards are defined by the most demanding approach to a runway. These airspace surfaces include the primary, approach, transitional, horizontal and conical surfaces each with different standards. The slope of an airspace surface is defined as the horizontal distance traveled for every one vertical foot (i.e. 50:1).

Of note is the primary surfaces which should be kept clear of non-essential objects above the runway centerline elevation. The approach surface extends upward and outward from the runway on a slope defined as the horizontal distance traveled for every one vertical foot (i.e. 50:1). The transitional surface is a 7:1 slope and extends to the side of the primary and approach surfaces. The following **Table 4-23** indicate the future approach airspace surfaces for Rapid City:

Table 4-23 – Future Part 77 Approach Airspace Requirements

Future Part 77 Approach Airspace Requirements						
Runway End	Approach Standards	Part 77 Code	Inner Width*	Outer Width	Length	Slope
14	Precision	PIR	1,000’	16,000’	50,000’	50:1/40:1
32	Precision	PIR	1,000’	16,000’	50,000’	50:1/40:1
5	Non-Precision Utility	A	500’	2,000’	5,000’	20:1
23	Non-Precision Utility	A	500’	2,000’	5,000’	20:1

**Inner width is also the Primary Surface width driven by the most demanding approach to a runway.*
Blue indicates change from existing conditions.
Source: 14 CFR Part 77, KLJ Analysis

New development should be kept below the Part 77 surface elevation. Airspace surfaces must clear public roads by 15 feet, interstate highways by 17 feet, railroads by 23 feet, and private roads by 10 feet or the height of the most critical vehicle.

For existing obstructions that cannot easily be removed, an aeronautical study should be completed to determine the aeronautical effect and identify potential mitigation strategies (i.e. lighting, marking). There are various existing Part 77 obstructions located around Rapid City that will be identified on the Airport Layout Plan for evaluation.

Runway Approach/Departures Surfaces

FAA identifies sloping approach surfaces that must be cleared at an absolute minimum for safety for landing aircraft. These surfaces are identified in Table 3-2 of FAA Advisory Circular 150/5300-13A, *Airport Design*. All objects must clear the surface for the applicable runway operational design standard to meet minimum aviation safety standards for a given runway landing threshold location. Approach airspace penetrations require mitigation which may include the removal of the object or the runway landing threshold to be shifted or displaced down the runway.

The departure surface applies to instrument departures. It begins at the end of the takeoff distance available and extends upward and outward at a 40:1 slope. Penetrations to the departure surface may simply require the obstacle to be published, or require mitigation including increasing the minimum aircraft climb rate or runway length operational restrictions.

When usable landing or takeoff distances do not match the runway length, then a special application of declared distances should be used to meet operational safety requirements. Declared distances can be used to mitigate approach/departure obstructions, land use incompatibilities, or incompatible airport design areas.

Per FAA Table 3-2, the following approach/departure surface standards apply:

Table 4-24 – Approach/Departure Surface Requirements

Approach/Departure Surface Requirements			
Runway End(s)	**Table 3-2 Row**	**Description**	**Slope**
Existing			
32	7	Instrument approaches having visibility minimums < ¾ statute mile	34:1
14	5	Approaches supporting instrument night operations in greater than Category B aircraft	20:1
5, 23	4	Approaches supporting instrument night operations in Category A and B aircraft only	20:1
All	9	Departure runway ends for all instrument operations	40:1
Future			
14, 32	7	Instrument approaches having visibility minimums < ¾ statute mile	34:1
5, 23	4	Approaches supporting instrument night operations in Category A and B aircraft only	20:1
All	9	Departure runway ends for all instrument operations	40:1

Note: Most critical row(s) shown. Only changes from existing shown in future.
Source: FAA Advisory Circular 150/5300-13A, KLJ Analysis

Critical obstructions to the existing approaches exist along the Runway 32 departure end. Several objects including the airport perimeter fence and ground penetrate the 34:1 approach surface. Improvements to the Runway 14 approach is expected to correct departure issues with Runway 32.

Terminal Instrument Procedures (TERPS)

The FAA has established standards to develop instrument procedures in the United States. FAA Order 8260.3B, *U.S. Standards for Terminal Instrument Procedures (TERPS)* and related orders outlines these complex standards to develop departure, climb, en-route, approach, missed approach and holding standards for aircraft operating along a published route with different navigational equipment. Some critical obstruction clearance standards are integrated into the approach/departure surfaces identified in Airport Design including many final approach segments and the 40:1 sloped departure surface. Other important obstacle clearance surfaces within the inner airport environment identified in TERPS include the precision obstacle clearance surfaces and the missed approach surfaces. Some TERPS surfaces may even be more restrictive that Part 77 standards. Penetrations to TERPS surfaces results in higher weather minimums or operations restrictions.

Other Design Surfaces

Other airport design airspace surfaces considered protect navigational aids and identify airport data to populate FAA databases.

Inner-Approach/Transitional Obstacle Free Zones

If an approach lighting system is installed, a clear inner-approach and inner-transitional Obstacle Free Zone (OFZ) is necessary. The inner-approach OFZ is a 50:1 sloped surface begins 200 feet from the runway threshold and extends 200 feet beyond the last approach light. The inner-transitional OFZ airspace surface is along the sides of the ROFZ. No objects not necessary for airport operations, including aircraft tails can penetrate this surface. There are no objects that penetrate this surface at Rapid City.

Precision Obstacle Free Zone (POFZ)

If a precision instrument approach is established there exists a POFZ which begins at the runway threshold as a flat surface 800 feet wide centered on the runway centerline and extending 200 feet to connect to the inner-approach OFZ. As with the OFZ, no objects not necessary for airport operations including aircraft or vehicles on the ground can penetrate this surface. This surface is currently clear of all objects where it applies at Runway 32 and the requirements will apply to Runway 14 when a precision approach is established.

Airport Surveillance Radar (ASR)

The Dakota Air Traffic Control Facility, located at Ellsworth AFB, has a Digital Airport Surveillance Radar (DASR) which provides primary radar coverage for terminal airspace in the vicinity of the airport. The DASR site at Rapid City is located along Radar Hill Road, 2.5 miles northwest of the airport and is maintained by the U.S. Air Force.

Visual Aids

Visual aids at an airport require clear line of sight to provide sufficient guidance for pilots. These include approach lighting systems and visual guidance slope indicators. For a Precision Approach Path Indicator (PAPI) system, this surface begins 300 feet in front of the VGSI system and extends upward and outward at an angle 1 degree less than the lowest on-course aiming angle. For a standard 3 degree glide path this equates to a 31.29:1 sloped surface. The specific airspace standards for this and for approach lighting systems are defined in FAA Order 6850.2B.

FAA Aeronautical Surveys

The FAA has implemented Aeronautical Survey requirements per Advisory Circular 150/5300-18B *General Guidance and Specifications for Submission of Aeronautical Surveys to NGS: Field Data Collection and Geographic Information System (GIS) Standards*. FAA airport survey requirements require obstruction data to be collected using assembled aerial imagery for the airport. This data is used in aeronautical publications and to develop instrument approach procedures.

An updated aeronautical survey is being conducted with this planning effort. Imagery was acquired in 2014. As of FY 2013, all projects at this airport must now comply with Airports GIS standards. When runway ends change or an enhanced instrument approach is proposed then a new obstruction analysis is necessary. Obstructions that have been removed can be deleted from the database by coordinating with FAA Flight Procedures Office.

Navigational Aids

Airfield NAVAIDs are any ground or satellite based electronic or visual device to assist pilots with airport operations. They provide for the safe and efficient operations of aircraft on an airport or within the vicinity of an airport. The type of NAVAIDS required are determined by FAA guidance based on an airport's location, activity and usage type.

Area Navigation

The FAA is updating the nation's air transportation infrastructure through the Next Generation Air Transportation System (NextGen) program. New procedures and technology are to be implemented to improve the efficiency and safety of the national air transportation system. For area navigation, satellite-based NAVAIDs will primarily be used for air navigation with ground-based NAVAIDs used for secondary purposes. Other initiatives include implementing a new surveillance technology for tracking aircraft known as Automatic Dependent Surveillance-Broadcast (ADS-B) to improve position accuracy reporting and supplement ground radar data for air traffic control.

Rapid City should plan for the use of satellite-based area navigation. Satellite based RNAV approaches have been created for all four runway approaches. These approaches do not rely on ground-based NAVAIDs such as the existing Very-high Frequency Omni-directional Range (VOR) which are planned for decommissioning by the FAA in the long term future. It is also anticipated that the existing Airport Surveillance Radar will be replaced by ADS-B.

Runway Approach

Other NAVAIDs are developed specifically to provide "approach" navigation guidance, which assists aircraft in landing at a specific airport or runway. These NAVAIDs are electronic or visual in type. FAA Order 6750.16D, *Siting Criteria for Instrument Landing Systems* and FAA Order 6850.2B, *Visual Guidance Lighting Systems* defines the standards for these lighting systems.

Instrument Landing System (ILS)

An ILS is a ground-based system that provides precision instrument guidance to aircraft approaching and landing on a runway. ILS approaches enable a safe landing in IMC with low cloud ceiling and/or visibility. Major components of ILS include the localizer antenna for horizontal guidance, glide slope antenna for vertical guidance and an approach lighting system. The localizer and glide slope require critical areas that are sufficiently graded and do not contain certain objects.

There are three categories of ILS systems, each capable of supporting approaches in equipped aircraft with lower weather minimums. Each category also requires an increasing complexity of airport equipment as well as aircraft and flight crew certifications. Currently Runway 32 is equipped with a Category I ILS approach. It is proposed to plan for a Category I ILS in the future for Runway 14. Ultimately, the ground-based localizer and glideslope systems may eventually be replaced by precision GPS systems.

Table 4-25 – Standard ILS Categories

Standard ILS Categories		
ILS Category	**Decision Height (ft.)**	**Runway Visual Range (ft.)**
Category I	200	2,400/1,800
Category II	100	1200
Category IIIa	0-100	700
Category IIIb	0-50	150
Category IIIc	0	0

Source: FAA Aeronautical Information Manual

Visual Guidance Slope Indicator (VGSI)

A VGSI system provides visual descent guidance to aircraft on approach to landing. There are several types of VGSI systems available including a Precision Approach Path Indicator (PAPI) system and a Visual Approach Slope Indicator (VASI). These systems are typically installed on runway ends with instrument approaches and co-located with the glideslope antenna, but are also installed for visual runways. PAPI systems, a newer technology, consist of a single row of two to four lights. The two light system is for non-jet runways and the four light system is for jet-capable runways.

Unlike most airports, Rapid City maintains the PAPIs for all four runways at the airport. This equipment has become outdated and it is proving difficult to obtain parts. **Rapid City should replace the existing PAPI system for all four Runways or work with the FAA for the FAA to install and begin to maintain PAPIs for the airport.** All PAPIs should meet obstacle clearance requirements.

Runway End Identifier Lights (REIL)

REILs consist of high-intensity flashing white strobe lights located on the approach ends of runways to assist the pilot in early identification of the runway threshold. Additionally, these are typically installed on runways that are surrounded by a preponderance of other lights or if the runway lacks contrast with surrounding terrain. These are not installed with an approach lighting system.

The REILs for Runway 14 should be maintained until such time as an approach lighting system is installed for a precision instrument approach to Runway 14.

Approach Lighting System (ALS)

ALSs help pilots transition from instrument flight to visual flight for landing. An ALS is required as part of an ILS. An ALS installed on non-precision approach runways can help provide ¼ mile visibility credit for instrument approach minimums. There are various configurations, lighting types and complexities to these systems. The requirement for an airport runway end is dependent upon the type of precision approach and visibility minimums of the approach.

The type of ALS which should be considered at Rapid City is the Medium-intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR). The MALSR consists of seven rows of lights, five flashing lights and a row of steady burning green

lights prior to runway threshold. The system is 2,400 feet in total length. This is required for the Category I approach for Runway 32 and will be required for a Category I approach for Runway 14.

Airfield Visual

Visual NAVAIDs provide airport users with visual references within the airport environment. They consist of lighting, signage and pavement markings on an airport. Visual NAVAIDS are necessary airport facility components on the airfield, promoting enhancing situational awareness, operational capability and safety. FAA Advisory Circular 150/5340-30E, *Design and Installation of Airport Visual Aids* defines the standards for these systems.

Airport Beacon

The airport beacon serves as the airport identification light so approaching pilots can identify the airport location during night and IMC. The airport beacon's location at Rapid City is outside of any development areas and adequately serves the airport without known obstruction to its line of sight. If the Airport Traffic Control Tower is relocated in the future, it will be necessary to assure that the airport beacon does not impair the controllers' field of vision. This could require the airport beacon to be relocated.

Runway Lighting

Runway edge lights are placed off the edge of the runway surface to help pilots define the edges and end of the runway during night and low visibility conditions. Runway lights are classified according to the intensity of light they produce including high intensity (HIRL), medium intensity (MIRL) and low intensity (LIRL). The existing HIRL for Runway 14/32 is required for RVR based minimums. Runway 5/23 has MIRL and this system is recommended for continued night operations.

Runway 14/32 has edge lighting that is installed with a modification to FAA standards. The FAA standards require the lighting to be spaced no more than 200 feet apart. There are four locations at Rapid City where the lighting for runway 14/32 is greater than 200 feet apart. These are at the runway 14/32 intersection with taxiways A3, A4, A5 and B. This modification to standards is approved by the FAA and recorded in the Airport Certification Manual.

Taxiway Lighting

Taxiway edge lighting delineates the taxiway and apron edges. The FAA standard taxiway edge lighting system is Medium Intensity Taxiway Lights (MITL). Taxiway edge lights are installed for all taxiways at Rapid City. Other taxiway lights are installed at airports to promote safe operations. These include taxiway centerline lighting, runway guard lights (RGL), runway stop bar and clearance bar. RGL are installed at all taxiway-runway intersections for Runway 14/32 and the intersection of Taxiway A and Runway 5/23 as recommended by FAA.

Airfield Signage

Airfield signage is essential for the safe and efficient operation of aircraft and ground vehicles on the airport movement area. Common signs include mandatory instruction signs, location signs, boundary signs, direction/destination signs, information signs and distance remaining

signs. Airports certificated under 14 CFR Part 139 such as Rapid City must have a sign plan developed and implemented to identify taxi routes and holding positions. This plan must be consistent with FAA Advisory Circular 150/5340-18F, *Standards for Airport Sign Systems*. This plan should be updated to meet current standards and operating procedures.

Pavement Markings

Pavement markings help airport users visually identify important features on the airfield. FAA has defined numerous different pavement markings to promote safety and situational awareness as defined by FAA AC 150/5340-1L, *Standards for Airport Markings*.

Runway

Runway pavement markings are white in color. The type and complexity of the markings are determined by the approach threshold category to the runway end. The minimum required runway markings for a standard runway are as follows:

- Visual (landing designator, centerline)
- Non-Precision (landing designator, centerline, threshold, aiming point)
- Precision (landing designator, centerline, threshold, aiming point, touchdown zone, edge)

Additional runway markings for blast pad and runway shoulders are also required. Runway 14/32 should continue to have precision markings maintained. Runway 5/23 now has a non-precision approach, thus non-precision approach markings should be maintained. Please note, since Runway 5/23 is less than 4,200' in length, an aiming point marking is not required.

Taxiway/Taxilane

Taxiway and taxilane markings are important for directional guidance for taxiing aircraft and ground vehicles. Common taxiway and apron markings include taxiway/taxilane centerline, edge and non-movement area boundary. Enhanced taxiway markings are required along taxiway centerlines that lead to runway entrances. Taxiway/taxilane centerline markings should be used throughout to define a safe centerline with object clearance. Taxiway/taxilane edge markings should be used to delineate the taxiway edge from the shoulder, apron or some other contiguous paved surface. The non-movement area boundary should be marked appropriately per ATCT line of sight requirements.

Holding Position

Holding position markings are a visual reference to prevent aircraft and vehicles from entering critical areas such as an active runway environment. These markings consist of yellow bars and dashes on a black background. The required setback is 250 feet from Runway 14/32 centerline, and 125 feet for Runway 5/23.

Meteorological

Aircraft operating to and from an airport require meteorological aids to provide current weather data. Weather information helps pilots make informed decision about flight operations. Airports have various aids installed providing local weather information.

Surface Weather Observation

The existing FAA-owned ASOS located east of Runway 32 is sufficient for the long-term. Weather observing systems are recommended to be kept clear of agricultural operations within 100 feet, clear of objects 15 feet below the sensor height within 500 feet, and clear of objects greater than 10 feet above the sensor within 1,000 feet. Should development be considered on the east side of the airport, the ASOS will need to be relocated.

Wind Cone

Wind cones visually indicate the current wind direction and velocity on an airfield. The primary wind cone and segmented circle is located east of Runway 32, adjacent to the ASOS and is in a central visible location, lighted for night operations. Lighted supplemental wind cones are installed around the airfield near Runway 14/32 and 23 ends to provide local surface wind direction information to pilots. Should development be considered for the east side of the airport, the wind cone will need to be relocated.

Other

Runway Visual Range (RVR) visibility sensor systems provide instant reporting of the visibility at targeted locations on the airfield. The existing Runway 32 system is installed to serve the touchdown zone for this runway end. An RVR will need to be installed to serve the touchdown zone for Runway 14 to allow for the precision instrument approach for Runway 14.

Communications & ATC

The ability for pilots to communicate with other pilots and air traffic control is critical for the safety and efficiency of the overall air transportation system.

Rapid City has an operating airport traffic control tower (ATCT) located south of SDARNG complex. ATCT provides clearances, radar advisories and safety alerts to IFR and VFR flights within the controlled Class D airspace. ATCT operates between 6 a.m. and 10 p.m. daily. Approach Control is provided by Ellsworth AFB and operates 24 hours per day. Airport communication frequencies are sufficient for Class D airport operation.

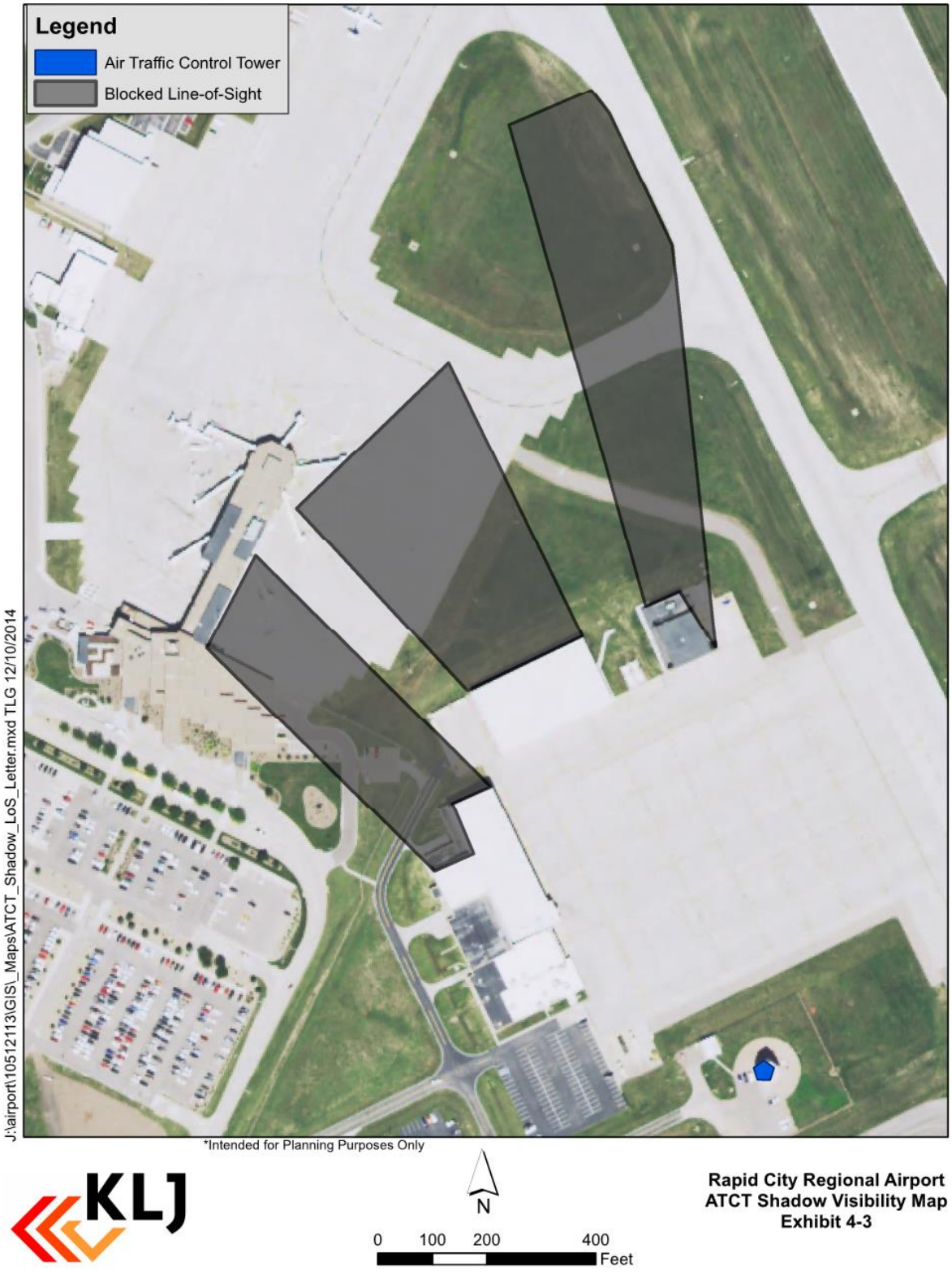
ATCT requires clear line of sight to the airfield. Currently, the tower has limited visibility to Taxiway T2 and the terminal apron as a result SDARNG buildings. A formal analysis of the visibility from the ATCT was not completed but a sight visit resulted in a general assessment showing the building shadows that exist from the tower. These shadows are portrayed in **Exhibit 4-3 ATCT Building Visibility Shadows**. In addition to the building visibility shadows, the ATCT staff advised that aircraft on Taxiway B, when they are near the approach end of Runway 23, are not visible due to terrain.

The tower is 50 years old and within the planning period the structure may need to be replaced on the current site or at another location. The potential addition of public airport access to the east side of the airfield could open new ATCT site options not previously explored. FAA Order 6480.4A, *Airport Traffic Control Tower Siting Process* identifies the criteria used for considering a new tower location:

1. Visual performance
2. TERPS airspace surfaces
3. FAR Part 77 airspace
4. Sunlight/daylight
5. Airport/background lighting
6. Atmospheric Conditions
7. Industrial Municipal Discharge
8. Site Access
9. Interior Physical Barriers
10. Security

The Airport Layout Plan will show the preferred site location based on a preliminary analysis. Additional research and modeling will be required prior to actual site selection. In order to replace the existing ATCT, either on site or at a new location, the airport will need to initiate an ATCT siting study which will be closely coordinated with the FAA.

Exhibit 4-3 ATCT Building Visibility Shadows



Taxiways

Taxiways provide for the safe and efficient movement of aircraft between the runway and other operational areas of the airport. The taxiway system should provide critical links to airside infrastructure, increase capacity and reduce the risk of an incursion with traffic on the runway. The taxiway system should meet the design requirements identified in FAA AC 150/5300-13A, *Airport Design*.

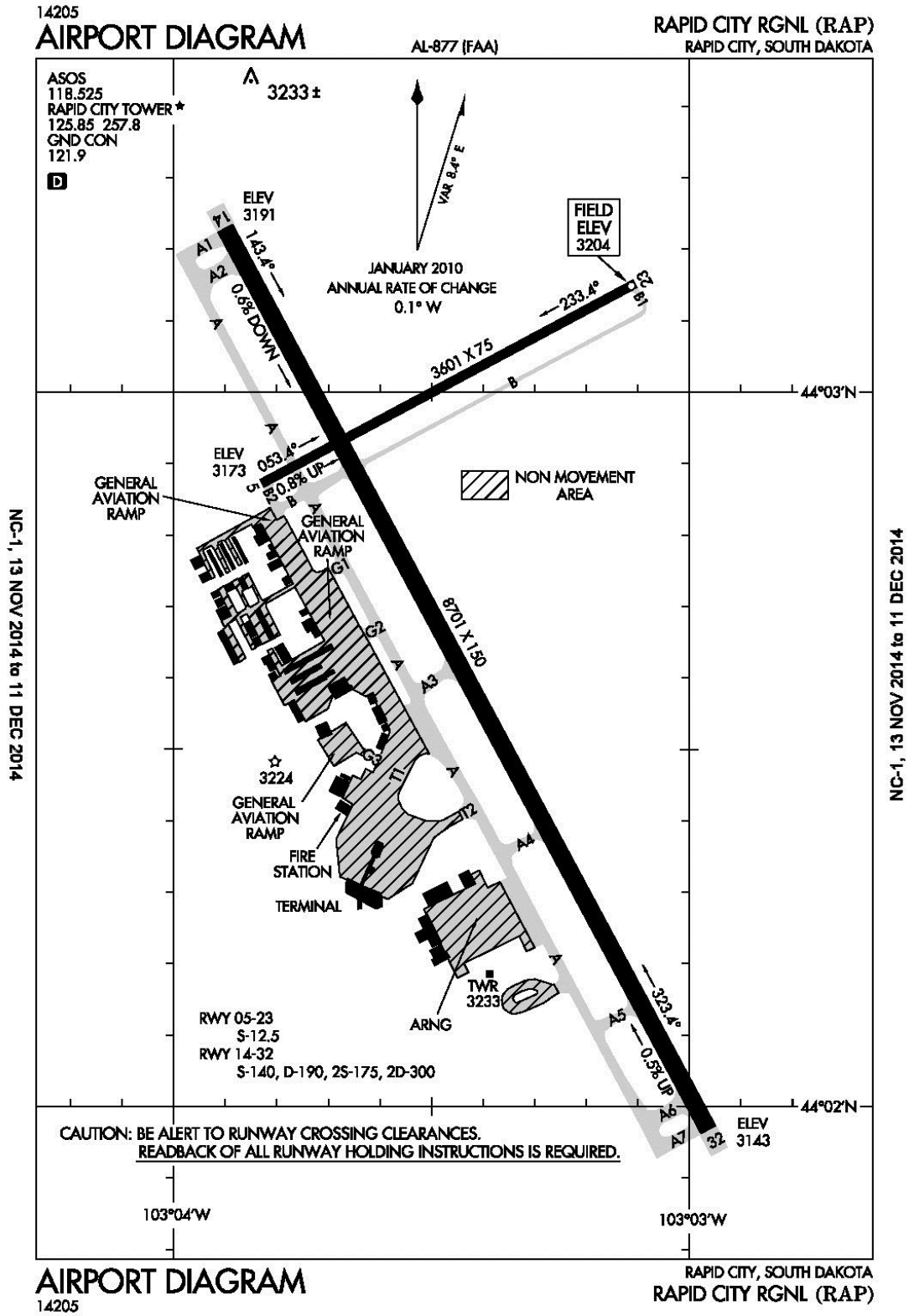
System Design

FAA has placed a renewed emphasis on taxiway design in the updated airport design standards (AC 150/5300-13A). In order to develop efficient systems that meet demands, reduce pilot confusion and enhance safety the following considerations were identified:

- Design taxiways to meet FAA design standards for existing and future users considering expandability of airport facilities.
- Design taxiway intersections so the cockpit is over the centerline with a sufficient taxiway edge safety margin.
- Simplify taxiway intersections to reduce pilot confusion using the three-node concept, where a pilot has no more than three choices at an intersection.
- Eliminate "hot spots" identified by the FAA Runway Safety Action Team where enhanced pilot awareness is encouraged.
- Minimize the number of runway crossings and avoid direct access from the apron to the runway.
- Eliminate aligned taxiways whose centerline coincides with a runway centerline.
- Other considerations include avoiding wide expanses of pavement and avoiding "high energy intersections" near the middle third of a runway.

Rapid City has no identified "hot spots" or other identified design problems with taxiways since Taxiway A was straightened recently to correct an FAA modification to standards.

Exhibit 4-4 – Rapid City Airport Diagram



Source: FAA Terminal Procedures

Design Standards

FAA identifies the design requirements for taxiways. The design standards vary based on the Taxiway Design Group (TDG) and Airplane Design Group (ADG) identified for the design aircraft using a particular taxiway. In addition to taxiway/taxiway pavement width, some of the safety standards include:

- Taxiway/Taxilane Safety Area (TSA) – A defined graded and drained surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft deviating from the taxiway. The surface should be suitable to support equipment during dry conditions
- Taxiway Edge Safety Margin (TESM) – The minimum acceptable distance between the outside of the airplane wheels and the pavement edge.
- Taxiway/Taxilane Object Free Area (TOFA) – An area centered on the centerline to provide enhanced the safety for taxiing aircraft by prohibiting parked aircraft and above ground objects except for those objects that need to be located in the OFA for aircraft ground maneuvering purposes.

Other design standards include taxiway shoulder width to prevent jet blast soil erosion or debris ingestion for jet engines, and required separation distances to other taxiways/taxilanes. A table describing the specific FAA taxiway design standards for various ADG and TDG design aircraft is identified in the following tables.

Table 4-26 - FAA Taxiway Design Standards Matrix (ADG)

FAA Taxiway Design Standards Matrix (ADG)		
Design Standard	**Airplane Design Group (ADG)**	
	ADG II* (Existing)	**ADG III* (Existing & Future)**
Taxiway Safety Area	79 feet	118 feet
Taxiway Object Free Area	131 feet	186 feet
Taxilane Object Free Area	115 feet	162 feet
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	105 feet	152 feet
Taxiway Centerline to Fixed or Movable Object	65.5 feet	93 feet
Taxilane Centerline to Parallel Taxiway/Taxilane Centerline	97 feet	140 feet
Taxilane Centerline to Fixed or Movable Object	57.5 feet	81 feet
Taxiway Wingtip Clearance	26 feet	34 feet
Taxilane Wingtip Clearance	18 feet	27 feet

ADG II applies to general aviation, ADG III applies to some general aviation and existing and future commercial service aircraft.

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

Table 4-27 – FAA Taxiway Design Standards Matrix (TDG)

FAA Taxiway Design Standards Matrix (TDG)			
Design Standard	**Taxiway Design Group (TDG)**		
	TDG 2* (Existing)	**TDG 3* (Future)**	**TDG 5* (Existing)**
Taxiway Width	35 feet	50 feet	75 feet
Taxiway Edge Safety Margin	7.5 feet	10 feet	15 feet
Taxiway Shoulder Width	10 feet	20 feet	25 feet
Taxiway Fillet Dimensions	See specific guidance in FAA AC 150/5300-13A		

**TDG 2 applies to existing general aviation, TDG 3 applies to future general aviation, TDG 5 applies to existing commercial service aircraft and overall airfield.*
Source: FAA AC 150/5300-13A Airport Design, KLJ Analysis

The existing airfield system serving Runway 14/32 has taxiways that are at least 75 feet in width sufficient to accommodate existing and future design aircraft. Taxiway A including A1, A2, A6 and A7 and T1 and T2 are designed to TDG 5 standards, A1 and A7 are 100 feet wide and A2 and A6 are 125 feet wide. Taxiways A3, A4, A5 and B (between A and Runway 14/32) are designed to TDG 4 standards for the filets. The remainder of Taxiway B that serves Runway 5/23 is 40 foot wide designed to TDG 2 standards. These taxiway design standards are considered to be sufficient through the planning period.

The only deficiency to the existing design standards is the lack of a taxiway shoulder. A paved taxiway shoulder width of 25 feet is required for taxiways supporting ADG-IV operations and recommended for taxiways supporting ADG-III aircraft.

Bypass Taxiways & Holding Bays

Bypass taxiways and holding bays provide the flexibility to allow runway use when an aircraft is not ready for takeoff and would otherwise block the taxiway. Runway departure delays can be caused by aircraft awaiting departure clearance or completing pre-flight checks. Bypass taxiways provide a secondary access to runways and can separate a mix of small and large aircraft at a runway end. Holding bays provide space for aircraft away from the taxiway environment. Both bypass taxiways and holding bays improve capacity and overall flow.

Rapid City has Taxiways A5 and A6 that can be used as a bypass taxiway within 1,200 feet of Runway 32. There is also Taxiway A2 that can be used as a bypass taxiway within 250 feet of Runway 14. These bypass taxiways should be sufficient to meet the needs at Rapid City through the planning period.

Rapid City does not have holding bays for any of the four runways. FAA recommends holding bays be constructed when peak hour operations reach 30. This is not forecast to occur in the planning period and therefore no holding bays are recommended for Rapid City.

Recommendations

Taxiway recommendations include the following:

- **Construct 25-foot wide paved shoulders for TDG-5 taxiways by PAL 1.**
- **Construct 20-foot wide shoulders for TDG-3 and 4 taxiways by PAL 1.**

Passenger Terminal

The requirements identified for the passenger terminal are identified to accommodate the travelling public with a sufficient level of service based on existing and projected growth. The airport has completed significant upgrades in the terminal building over the past several years including an expanded passenger screening area, expanded concessions in the concourse, expanded rental car area and remodeling throughout.

Currently, the passenger terminal building and concourse consists of approximately 90,000 total usable square feet, including offices, administration, ticketing, baggage, security, concessions, holdrooms/gates, storage and mechanical spaces. Public space open to everyone in non-secure areas is about 29,600 square feet, and sterile areas for passengers that require security clearance is about 24,100 square feet including the security checkpoint. Rapid City has seven gates in the concourse.

This section will identify key issues with the existing passenger terminal building and provide planning-level conceptual planning and space requirements. Landside requirements for passenger loading/unloading and automobile parking are evaluated separately. Requirements identified as based on the following references to FAA, Transportation Security Administration (TSA), International Air Transport Association (IATA), and industry standards:

- FAA Advisory Circular AC 150/5360-13A, *Planning and Design Guidelines for Airport Terminal Facilities* (2012)
- Airports Cooperative Research Program (ACRP), Report 25: *Airport Passenger Terminal Planning and Design Guidebook* (2010)

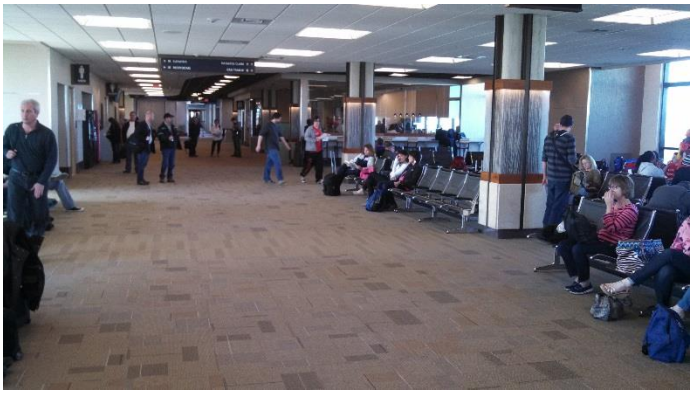
The first step is to identify the terminal space needs for Rapid City to provide a terminal building that meets passenger demands and exceeds expectations. Once the space needs are identified, future terminal building configuration alternatives will be developed in the next chapter. The airport will need to know how future expansion will be accommodated. Broad recommendations will be made in this study; details on a specific interior layout and engineering and architectural review would be identified in a separate terminal master planning study.

Terminal Design

Overall Considerations

Terminals are designed to handle passenger volume and functions to interface between aircraft and ground transportation. Terminals must accommodate changes in the airline industry and passenger preferences. Factors that influence terminal design include:

- Total Passenger Volume – The annual number of passenger enplanements affects the total size and recommended configuration of a terminal building.
- Passenger Peaking Characteristics – Arriving or departing flights concentrated into a small timeframe require adequate space and throughput for surges in passenger ticketing, security, gates, baggage claim and concessions.
- Passenger Preferences – Business travelers typically are more experienced with airports, demand shorter wait times and efficiency. Leisure passengers require more time, attract meters/greeters and typically have more baggage to process. Airline fees also drive passenger preferences to check or carry-on baggage.



- Airline Station Characteristics – A spoke airport such as Rapid City has destinations as airline hubs. Spoke airports accommodate origin & destination (O&D) passengers rather than using the airport to connect to another flight. Aircraft tend to remain overnight for the first flight out to a hub airport. All passengers have a requirement for check-in, security, baggage, ground transportation and parking.
- Aircraft Mix – The size and frequency of the aircraft activity affects the number and size of the gates, passenger waiting holdroom and the terminal apron configuration.
- International Service – Airports with international service require aircraft to have longer gate occupancy times and additional space for Federal Inspection Services (FIS)
- Industry Trends – Industry changes are affecting terminal design. Examples include reduced airline flight frequency, higher load factors, aircraft types, use of check-in kiosks, TSA pre-check program and airline fees affecting baggage.

Level of Service

Terminal improvements are evaluated in their ability to serve passengers and provide a comfortable experience through the airport. A Level Of Service (LOS) concept uses a set of standards to measure the quality of the passenger experience. LOS standards are used to evaluate the efficiency of passenger flow, space requirements and wait time. Each LOS has a defined space planning standard to determine facility requirements.

Table 4-28 – Level of Service (LOS) Standards

Level of Service (LOS) Standards		
LOS		**Service Level**
A	Excellent	Conditions of free flow; no delays; direct routes; excellent level of comfort
B	High	Condition of stable flow; high level of comfort
C	Good	Condition of stable flow; provides acceptable throughput; related systems in balance
D	Adequate	Condition of unstable flow; delays for passengers; condition acceptable for short periods of time
E	Unacceptable	Condition of unstable flow; subsystems not in balance; represents limiting capacity in the system
F	System Breakdown	Unacceptable congestion and delays

Source: ACRP Report 25: Airport Passenger Terminal Planning and Design

The assumption for this master plan is to obtain LOS C which peak wait times are 10 minutes or below. Delays and space requirements are typically considered acceptable. LOS C is considered reasonable balance between ideal size and economic considerations.

Rapid City Considerations

There are specific space-planning considerations at Rapid City that need to be evaluated in this study. One consideration is determining the ideal terminal layout. The number of gates and the size of the design aircraft is critical in planning a future layout.

Demand Factors

The primary function of a terminal is to provide adequate space to serve passengers. An evaluation of the passenger and gate demand is first completed to provide overall terminal space planning metrics at Rapid City.

Passenger Activity Levels

The following planning activity levels (PAL) numbers are to be used for terminal building planning. These figures provide an estimate of the number of passengers to arrive, depart and generally flow through the terminal building. The figures are based on a percentage of total enplaned passengers distributed based on the existing airline schedule. No surge factor is provided for irregular operations.

Table 4-29 – Terminal Passenger Activity Levels

Terminal Passenger Activity Levels					
Metric	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Terminal Passengers					
Annual Enplanements	256,191	275,634	296,254	318,133	341,298
Design Hour Departing	201	216	233	250	268
Design Hour Arriving	201	216	233	250	268
Design Hour Total Seats	295	317	341	366	393

Source: KLJ Analysis

Design Hour & Fleet Mix

The aircraft fleet mix in the terminal area is determined using the total number of forecast departures as shown during the design hour. The design hour is the early morning block of flights where four flights depart Rapid City. Aircraft types are grouped in Airplane Design Group (ADG) and class. The design aircraft for Rapid City will remain a narrowbody aircraft accommodating 110 to 177 passengers. The airlines serving Rapid City will be increasing the sizes of the smallest aircraft in the market which will increase enplanements but leave operations relatively flat. The aviation forecasts project the average number of seats per aircraft will increase. As a result, the total number of flights is projected to increase 4 percent while the total number of passengers will increase nearly 33 percent through PAL 4.

Table 4-30 - Design Hour Departures

Design Hour Departures						
Design Aircraft	**Seats**	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Regional Aircraft (ADG II)	40-60	3.82	3.63	3.47	3.40	3.38
Regional Aircraft (ADG III)	61-99	0.36	0.41	0.46	0.66	0.63
Narrowbody Aircraft (ADG III)	100-120	0.00	0.11	0.29	0.28	0.27
Narrowbody Aircraft (ADG III)	121-150	1.18	1.05	1.04	1.02	1.19
Narrowbody Aircraft (ADG III)	151+	0.04	0.00	0.15	0.14	0.14
Design Hour Departures	**-**	**5.4**	**5.2**	**5.4**	**5.5**	**5.6**

Source: KLJ Analysis

Gate Requirements

Gates are necessary for aircraft to adequately serve arriving and departing aircraft. The minimum number of gates at an airport is a function of the peak hour activity. Additional contingency metrics are also used to determine the required gates. At Rapid City the peak gate utilization period is the early morning departure block which exceeds the demand of the late evening arrival period. One contingency gate is added to accommodate unscheduled charter flights or long-term delayed flights.

Table 4-31 - Gate Requirements

Gate Space Requirements					
Design Aircraft	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Design Hour Departures	5.4	5.2	5.4	5.5	5.6
Contingency Gate	1.0	1.0	1.0	1.0	1.0
Total Gates	6.4	6.2	6.4	6.5	6.6
Total Required Gates	**6**	**6**	**6**	**7**	**7**

Source: KLJ Analysis

The total required gates is then split up into aircraft types using the fleet mix determinations to determine the total and equivalent number of gates for space planning. There are seven gates at Rapid City able to accommodate regional and narrowbody aircraft simultaneously with a passenger boarding bridge (PBB). The existing gates are designed to meet the size of the design aircraft. Two parking stands with PBB access are available at gates 5 and 7 for overnight parking. The contingency gates should accommodate the occasional use of a narrowbody aircraft for nonscheduled operations.

Table 4-32 – Gate Space Requirements

Gate Space Requirements					
Design Aircraft	**Existing /Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Medium Regional Aircraft (ADG-II)	0	4	3	3	3
Large Regional Aircraft (ADG-III)	4	0	1	1	1
Narrowbody Aircraft (ADG-III)	3	1	1	2	2
Total Number of Gates	**7**	**5**	**5**	**6**	**6**
Narrowbody Equivalent Gate (NBEG)	7.0	3.8	4.1	5.1	5.1
Equivalent Aircraft (EQA)	5.0	2.6	2.7	3.7	3.7

Source: KLJ Analysis

Rapid City will not require any additional gates during the planning period. The increased amount of Large Regional and Narrowbody Aircraft may require aircraft parking to be reconfigured but is feasible within the current gate positions and terminal structure.

Building Areas

Individual functional areas of the terminal building have been evaluated to determine planning-level space needs to accommodate current and future demand. Space requirements will be a major consideration when evaluating terminal building alternatives.

Airline Space

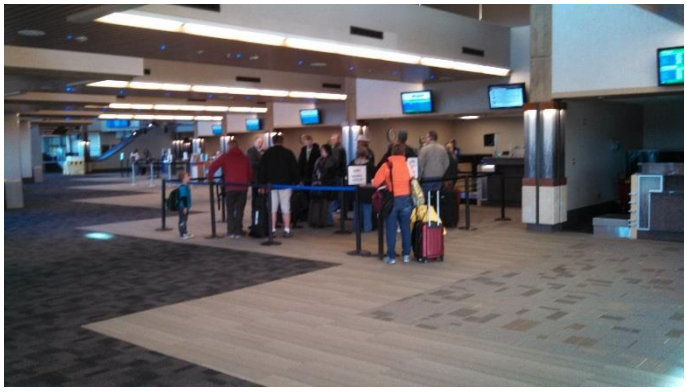
There is currently 11,030 square feet of area behind the ticketing counters dedicated for airline offices and baggage make up. There are a total of six airline areas within this space. Average space per office is 558 square feet. A common industry planning factor is 900 square feet per office. The amount of space required is a function of the total number of airlines serving the airport rather than the total volume of passengers. There are four airlines serving Rapid City presently and two different companies currently provide ticketing and ground handling services for these four airlines. DGS serves Delta and United and World Wide serves both American and Allegiant. If a new airline enters into the Rapid City market then existing office space is available. There is sufficient space to accommodate up to six airlines at Rapid City.

Other airline space considerations include airline ramp offices and support facilities on the airside portion of the airport. These are used for airline ground servicing functions. There is currently 6,439 square feet of office and garage space provided on the concourse lower level used among the two service providers for four airlines at Rapid City. Using a planning space metric of 1,300 square feet per office and 2,500 square feet for ramp services, there is a need for 11,400 square feet of space. The airlines are able to adequately function with the existing space as some services are contracted to other providers. Additionally, lower level of the concourse has approximately 13,200 square feet of space available for expansion to meet any future space needs. The total airline ramp space needs are forecast to be fully met into the future.

Baggage Service Offices (BSO) provide handling and storage for late or unclaimed bags. There is not currently a BSO facility at Rapid City. Baggage is stored in a secure area and retrieved

from the airline ticket counters. While the amount of space is sufficient to meet current demands the lack of a physical location in the bag claim area makes it confusing for passengers who are needing assistance with late bags. Recommendations on how to address this issue will be made in the Alternatives Chapter.

Ticketing & Check-In



The passenger check-in process continues to change as new technologies and processes are implemented. These changes have reduced the space needed in the ticketing lobby space and staffed ticket counter positions. Waiting times are also reduced. Traditionally, all passengers checked in at the ticket counter to both receive boarding passes and check baggage. Now, remote self-service equipment allows individuals to obtain boarding passes online or at the airport without the need to use staffed ticket counters. Checked baggage is accommodated by a dedicated airline bag-drop representative at the counter. The use of self-service equipment continues to grow. Potential future trends include self-tagging stations and remote off-airport bag-drop facilities which would reduce the need for staffed positions at the airport.

The passenger check-in assumptions are important to evaluate space and facility needs. For planning purposes the following assumptions are made:

- Passengers Checking Baggage: Average is 50 percent with 70 percent for leisure flights
- Checked Baggage Location: 100 percent within the terminal, 0 percent curbside, 0 percent remote location
- Passenger Check-In Location: 30 percent remote, 30 percent in-terminal kiosk, 40 percent in-terminal counter

The ticketing lobby at Rapid City currently consists of 6,127 square feet for ticket counters and queuing with a total of 22 available check-in positions provided at the airport with 66 linear feet of counter space. The airlines lease 8 staffed counters and provide two positions per counter for a total of 16 positions. Each 440 square foot ticket counter area also currently houses at least one of five Transportation Security Administration (TSA) pieces of equipment and associated staff to conduct checked baggage screening. The screening equipment and the logistics of TSA's working in this area are discussed later.

Many airlines also provide self-service kiosks near their ticket counter area mostly within the ticket counter queue. There are several check-in kiosks located in the corridor, owned by Delta Air Lines, United Airlines and American Airlines. There are no curbside check-in facilities provided. The ticketing lobby has a 24 foot queue depth which is more than the FAA's minimum recommendation of 15 feet.

Table 4-33 – Ticketing Requirements

Ticketing Requirements						
Metric	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Staffed Ticketing Positions	*16*	9	12	12	13	14
Staffed Bag Drops	-	2	3	3	3	3
Number of Dedicated Kiosks	*6*	4	5	6	6	7
Total Staffed Positions	*16*	11	14	15	16	18
Total Equivalent Positions	-	13	16	17	19	20
Total Queue Area (SF)	*3,475*	1,717	2,148	2,309	2,479	2,660

RED indicates a deficiency to existing facilities
Source: KLJ Analysis

The total number of airport provided ticketing positions meets the needs through PAL 4. Each individual airline is responsible for leasing space to allow customers adequate space and check-in options. Additional positions may be provided for frequent fliers and/or first class customers. Most airlines at Rapid City require customers to proceed to a check-in position where an agent and a kiosk are available. It is recommended additional self-service kiosks be installed in the ticketing areas with staffed bag drops. Kiosks reduce passenger waiting time and require minimal space.

A simple review shows there is sufficient total queuing space for passengers. There will be individual peak periods that may exceed leased space in front of each airline counter and queue area. The space is available from the airport but is it the responsibility of each airline to lease the space for passenger exclusive use.

Curbside check-in is provided to enhance the LOS and reduce congestion within the ticketing lobby. Rapid City does not offer curbside check-in. There is adequate space and a high LOS within the existing ticketing lobby. Curbside check-in would require a 30-foot wide curb, check-in podiums and with either a baggage conveyor or baggage cart.

Baggage Screening & Make-up

Baggage screening facilities are located within each individual airline ticket counter area. This equipment is operated by the TSA to screen checked bags for explosives. Bags are fed through one of three Explosive Detection System (EDS) machines or screened with one of four Explosive Trace Detection (ETD) stations. The Delta, United and Allegiant counters each have EDS machines. The American and vacant counters have the four ETD stations. Since the equipment is positioned separately there is limited ability to handle peaks from individual flights or redirect baggage when equipment is out of service. Once bags are cleared they are sent by baggage belt to the airlines bag make-up area to be carted to the aircraft. The screening equipment occupies a portion of the six 440 square foot ticket counter areas.

This arrangement of baggage screening is not recommended for the long term as it requires extra equipment and personnel and is unable to efficiently handle any surges. An in-line baggage screening arrangement is recommended as soon as practicable. The amount of space that will be required for this in-line baggage screening should be 3,380 square feet since this is the amount of space projected to be needed as early as PAL 2, see **Table 4-34**. This will

free up 1,155 square feet of space in the ticketing area that is currently used for baggage screening.

Baggage make-up facilities are located directly behind the airline offices. After the bags are screened behind the ticket counters by TSA staff, they are placed on bag belts which send them to the back of the airline office areas. Behind the airline office areas there is a small area for bag make-up exclusive to each airline connected to a driving corridor for baggage carts and tugs. This driving corridor is also used for the storage of ground support equipment. The area totals 8,699 square feet and includes the 3,323 square feet corridor for equipment maneuvering and 2,232 square feet in two empty airline areas physically separated and unavailable for general use. This results in an average of 786 square feet of space for each of the four airline positions for conveyors and loading baggage carts for a total effective space of 6,558 square feet including the maneuvering corridor. The current configuration is depicted in **Exhibit 4-5 Existing Baggage Handling Layout**.

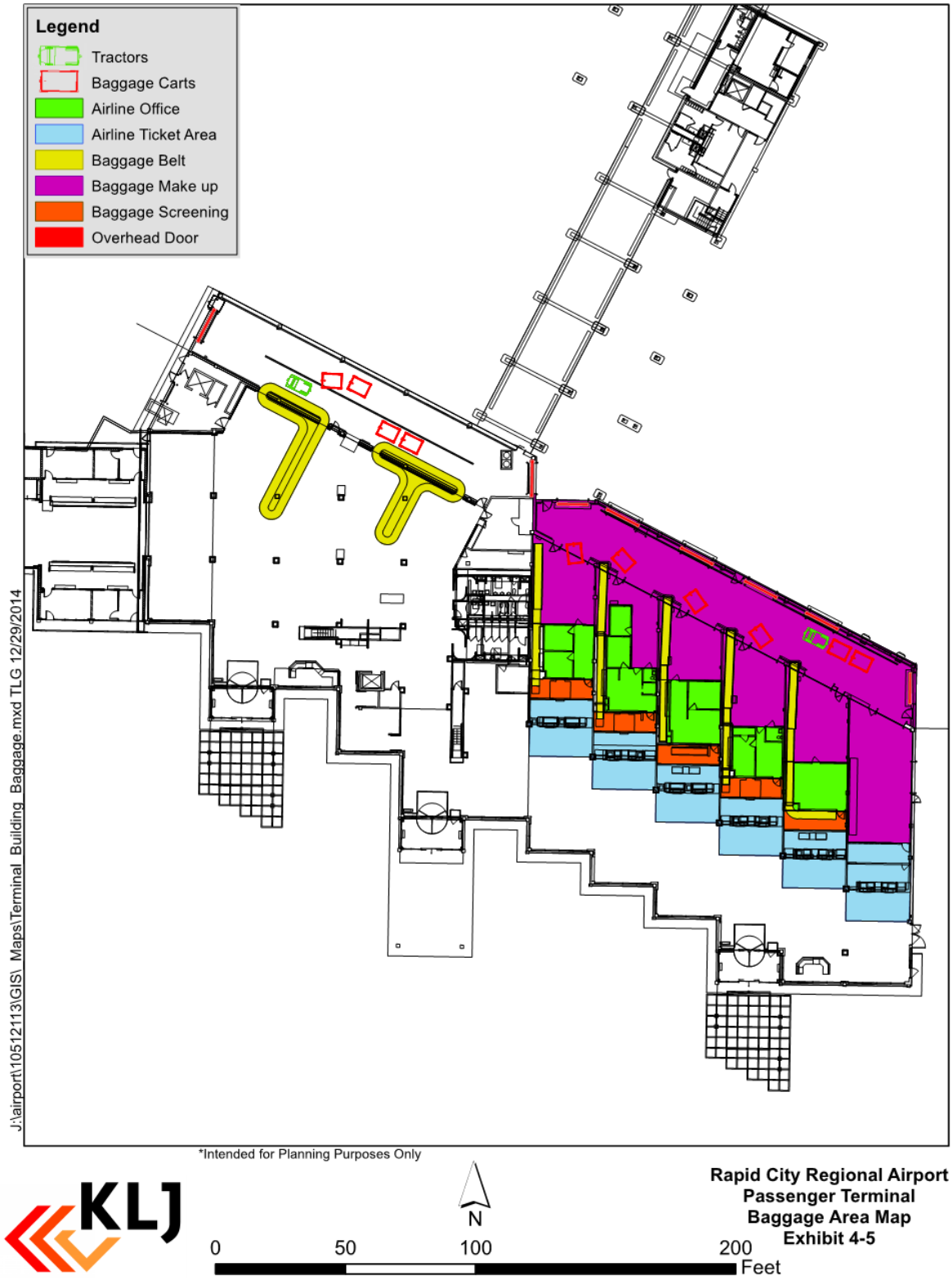
Table 4-34 – Baggage Screening & Make-Up Requirements

Baggage Screening & Make-Up Requirements						
Metric	***Existing***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Baggage Screening Area	*1,155**	2,580	2,580	3,380	3,380	3,380
Baggage Make-Up Area	*6,476***	5,700	5,900	5,900	8,100	8,100

** Baggage Screening is collocated with 2,652 square feet of airline ticket counter area and is not a separate space. ** Baggage Make-Up includes 4 airline positions and maneuvering corridor. 2,232 square feet of space is separated in two additional airline positions and not configurable for use with the existing four occupied positions.*
RED indicates a deficiency to existing facilities
Source: KLJ Analysis

Based on the volume of bags for Rapid City it is recognized that the airport currently needs 5,700 square feet of space for baggage make-up and 8,100 square feet by PAL 4. It is recommended that at the same time that the in-line baggage screening is created, that the airport also address the disjointed layout for baggage make-up. Recommendations on how to address this issue will be made in Chapter 5 Alternatives.

Exhibit 4-5 – Existing Baggage Handling Layout



Security Checkpoint

The Security Screening Checkpoint (SSCP) area is used by TSA to screen passengers and property prior to entering the sterile area of the terminal concourse. Rapid City has upgraded the facility to meet the current and future demands. There are currently 3 lines for checking passengers. One is configured for TSA PreCheck and the other two are for all other passengers. There are currently three x-ray machines for property search, two walk-through metal detectors, and one Advanced Image Technology (AIT) scanner, all staged in a wide corridor. There is a large queue area in front of the screening equipment. The total security and queue area is about 5,030 square feet in size. There is another 254 square feet of TSA screening and office space. The calculated maximum current wait time in queue is 4.9 minutes according to calculations using metrics from ACRP's terminal planning spreadsheet.

SSCP space requirements are driven by equipment and queuing space from the number of passengers and estimated throughput rate. Actual throughput rates of 175 passengers per hour per lane are common nationally. To achieve a maximum 10 minute queue wait time, all three security lanes are needed by PAL 2.

Table 4-35 – Security Screening Checkpoint Requirements

Security Screening Checkpoint Requirements						
Metric	***Existing***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Security Screening Lanes	*2*	2	2	3	3	3
Maximum Wait Time (min.)	*4.9*	4.9	11.1	2.3	4.0	5.7
Security Screening Area	*2,400*	1,250	1,250	1,875	1,875	1,875
Total Security Area	*5,666*	3,125	3,125	4,688	4,688	4,688

NOTE: Security Screening Checkpoint was expanded and upgraded in 2013.
Source: KLJ Analysis

Technology and processes will continue to evolve. The TSA PreCheck program will likely increase throughput which in the future may reduce the need for additional queuing areas.

Passenger Holdrooms

Passenger holdrooms are designated areas in the sterile concourse area where passengers wait to board the aircraft at the gate. The size of the holdrooms are directly related to the aircraft size at each gate. The estimated fleet mix is used to determine holdroom sizing for each gate. Each holdroom is sized assuming 80 percent of the total number of passengers are seated and the remaining 20 percent are standing. Additional space requirement for the gate podium and podium queue are also taken into account.

The terminal concourse was expanded in 2013 with additional concessions, restroom and passenger screening space. There is a total of 8,644 square feet of holdroom space for seven

gates. Holdroom seating capacity is often shared among several gates or in separate areas of the terminal. Cumulatively, total existing seating capacity is approximately 450 seats which provides seating for 59 percent of the peak hour departing passengers through the planning period.

The evaluation of holdroom requirements is based on the average number of passengers per aircraft per gate. The peak hour departure block requires five gates in the existing configuration with an additional two departures through PAL 4. This assumes a maximum of seven of the seven gates are in use at the same time for RON (Remain Over Night) flights.

The analysis concludes additional holdrooms will not be needed within the planning period.

Table 4-36 – Holdroom Requirements

Holdroom Requirements						
Metric	***Existing***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Design Aircraft						
50 passengers (1,000 SF)	*0*	4	4	3	3	3
76 passengers (1,400 SF)	*0*	0	0	1	1	1
110 passengers (1,800 SF)	*4*	0	0	0	0	1
138 passengers (2,200 SF)	*2*	1	1	1	1	1
166 passengers (2,600 SF)	*1*	0	0	0	0	0
Total Airline Gates In Use	*7*	5	5	5	5	6
Total Holdroom Area	*8,644*	6,200	6,600	6,600	6,600	8,400

Source: KLJ Analysis

Concourse Size & Circulation

The overall size of the terminal concourse was evaluated for future space planning. The exterior terminal frontage is based on the aircraft fleet mix parked at the gate with sufficient wingtip clearance between aircraft. The current concourse exterior frontage available to aircraft is 860 linear feet (LF) with a total length of 400 LF. The width of the terminal varies based on whether the terminal has gates on one or both sides (single vs. double loaded) and the corridor width. The current Rapid City terminal is double loaded with gates across from each other. The current corridor width is 22.5 feet for a walkway. The suggested minimum width for a double-loaded terminal is 20 feet for a high LOS facility. The concourse width is adequate to meet current standards within the planning period.

Table 4-37 – Concourse Size & Requirements

Concourse Size & Circulation Requirements						
Metric	***Exist.***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Narrowbody Equivalent Gate (NBEG)	7.0	3.8	3.8	4.1	5.1	5.1
Aircraft Frontage (LF)	*860*	571	584	640	661	652
Concourse Length* (LF)	*390*	255	262	290	301	296
Concourse Circulation Area (SF)	*5,160*	4,600	4,600	5,000	5,000	5,000
Concourse Width (ft.)*	*22.5*	20	22.5	22.5	22.5	22.5

**Assumes double-loaded concourse*

Source: KLJ Analysis

Baggage Claim & Handling

Baggage claim devices are provided for arriving passengers to retrieve their checked bags from the aircraft. Bags are offloaded from the aircraft, placed on baggage carts, transported to a baggage handling area and then offloaded onto the baggage belts in a secure area.

The baggage claim area at Rapid City has two flat-plate baggage claim devices each providing 62 LF of presentation frontage for a total baggage claim frontage space of 124 LF. There is approximately 7,160 square feet of baggage claim area connected directly to entry/exit corridors to the front of the terminal and to the car rental area. A doorway for distributing oversized baggage is located between the two baggage belts which provides limited room for claiming large bags as other passengers are also retrieving bags from the baggage belts. It is assumed 70 percent of passenger check bags.

Additional baggage claim frontage is needed to accommodate overall design hour baggage claim demands starting by PAL 4. The individual largest arriving aircraft will require additional frontage preferably using one claim device. Currently when a single narrowbody aircraft arrives, a single baggage claim device provides only 62 feet of frontage which is less than the industry recommended 90 feet. The second baggage claim device can be used but it would be confusing for passengers and require extra baggage tugs. No change is recommended at this time but the baggage claim devices should be monitored for any congestion issues with narrowbody aircraft.

Table 4-38 – Baggage Claim & Handling Requirements

Baggage Claim & Handling Requirements						
Metric	***Exist.***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Peak People at Claim	-	57	71	77	83	88
Baggage Claim Frontage	*124*	86	107	115	124	133
Peak Single Aircraft Frontage	*62*	90	90	90	90	90
Total Baggage Claim Area	*7,160*	3,425	4,277	4,613	4,950	5,306
Total Baggage Handling Area	*3,428*	3,400	3,400	3,400	3,400	3,400

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

The baggage handling area is approximately 3,428 square feet in size. The baggage handling area requires a baggage tug drive lane, offloading zone and bypass lane. Multiple flights arriving near the same time will also require additional space to drive around active unloading operations. The existing depth is 23 feet and is adequate for the planning period.

Total percentage of passengers checking bags dramatically changes the baggage claim requirements. Baggage trends should continue to be monitored by the airport with space needs updated. Over the past several years airline fee structures have charged for checked bags reducing demand. The trend is for airlines to charge for carry-on bags as well which may cause the number of checked bags to increase again.

Concessions

Concessions are areas within the airport terminal used for retail space located in the public and sterile portions of the terminal. Airport industry trends demand more concessions in the sterile portion of the terminal as passengers have increased dwell times after the security checkpoint. Additionally liquids, aerosols and gels are heavily restricted through the checkpoint. Currently 70 percent of the concession area is located in the public area with 30 percent in the sterile concourse.

Concessions located in the public area include a 4,686 square foot restaurant which was renovated in 2013 with the remainder of the terminal. A unique outside eating area was added on top of the terminal which adds 4,000 square feet as weather permits. Within the sterile concourse concessions include an 875 square foot news/gift shop and a 1,059 square foot cafe/bar area. Other amenities such as vending machines are included in the terminal.

Rental Car

Near baggage claim in the public area, there are four rental car counters at Rapid City totaling about 3,310 square feet. The size of the offices are sufficient. The queue area is not designated but is a portion of the 22 foot wide corridor separating the facing ticket counters. This corridor is also used for rental car customers exiting the terminal to the parking lot. All four rental car counters and offices are occupied, so there is no space constructed for additional providers.

Table 4-39 – Rental Car Requirements

Rental Car Requirements						
Metric	***Exist.***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Number of Providers	*4*	4	4	4	5	5
Rental Car Office Area (SF)	*903*	900	900	900	1,125	1,125
Rental Car Counter Area (SF)	*651*	648	648	648	810	810
Rental Car Area (SF)	*3,310*	2,748	2,748	2,748	3,435	3,435

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

The deficiencies identified in the table are based on one additional car rental agency operating from the airport. While the identified car rental area does not have space reserved for expansion there is space in the meeter/greeter arrivals area, adjacent to the rental car area, which can be modified for such use. In addition to the rental car area there is 193 square foot space used by Rapid Shuttle which is in the arrivals area of the terminal.

Airport Administration

The Airport Administration terminal areas include staff operations, offices and conference rooms. This includes 2,631 square feet of space, all on the second level adjacent to the concourse entry. This space should provide sufficient space through the planning period.

Public Spaces

Public spaces include non-revenue generating areas of the terminal building used for restrooms, circulation, as seating and waiting areas. Including sterile and non-secure areas, 3,817 square feet is dedicated to public restrooms. The number of restrooms is based on the design hour passengers in the public area, and on the number of equivalent aircraft within the secure area. Restrooms are located in adequate locations within the sterile and non-secure areas.

Table 4-40 – Restroom Requirements

Restroom Requirements						
Metric	***Exist.***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Sterile Area						
Male Restrooms	*12*	4	4	4	4	4
Female Restrooms	*10*	3	3	4	4	4
Family Restrooms	*1*	1	1	1	1	1
Total Fixtures	*23*	8	8	9	9	9
Non-Secure Area						
Male Restrooms	*10*	5	5	5	6	6
Female Restrooms	*13*	4	5	5	5	6
Family Restrooms	*1*	1	1	1	1	1
Total Fixtures	*24*	10	11	11	12	13

Source: KLJ Analysis

The meet/greet areas has traditionally been on the second level prior to security or in the baggage claim area. The second level area is 6,546 square feet of space adjacent to the open seating area of 4,686 square foot restaurant area. The restaurant area is open yet unlighted after hours so that overflow meters and greeters can enter this area.

General circulation within the terminal is adequate but includes some narrow areas of movement in the baggage claim area with escalators and stairs. A general minimum corridor width standard of 15 feet is considered minimally acceptable to clear of objects and queuing lines within the terminal, with a 30 foot wide corridor for a double-loaded terminal concourse. The corridor near the rental car counters provides 22 feet of width including queuing and is generally adequate.

The exit from the rental car area to the parking lot however has two automatic doors which are only 3.5 feet wide. A passenger must make a 90 degree turn to enter the vestibule through the first doorway then another 90 degree turn in the vestibule before exiting the second doorway. There is less than 10 feet of distance separating the two doorways. This vestibule exit should be addressed in the short-term.

The lobby on the first floor of terminal is of sufficient size to accommodate current and future passenger circulation.

Circulation efficiency is a product of good wayfinding signage. No deficiencies were noted but as changes do take place in the terminal signage must be adjusted to properly direct the public to terminal building services.

Recommendations

Below is a table summarizing the identified space requirements for the passenger terminal building:

Table 4-41 – Passenger Terminal Building Space Requirements

Passenger Terminal Building Space Requirements						
Metric	***Exist.***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Demand						
Annual Enplanements	-	256,191	275,634	296,254	318,133	341,298
Building Areas						
Total Required Gates	*7*	6	6	6	7	7
Airline Ticket Office (SF)	*3,350*	4,000	4,000	5,000	5,000	5,000
Airline Ramp/Support (SF)	*6,439*	7,600	7,600	11,400	11,400	11,400
Staffed Equivalent Positions	-	13	16	17	19	20
Dedicated Kiosks	*6*	4	5	6	6	7
Baggage Screening Area (SF)	*1,155*	2,580	2,580	3,380	3,380	3,380
Baggage Makeup Area (SF)	*6,476*	5,700	5,900	5,900	8,100	8,100
Security Screening Lanes	*2*	2	2	3	3	3
Total Security Area (SF)	*5,666*	3,125	3,125	4,688	4,688	4,688
Total Holdroom Area (SF)	*8,644*	6,200	6,600	6,600	6,600	8,400
Aircraft Frontage (LF)	*860*	571	584	640	661	652
Concourse Circulation (SF)	*5,160*	4,600	4,600	5,000	5,000	5,000
Baggage Claim Frontage (LF)	*124*	86	107	115	124	133
Baggage Claim Area (SF)	*7,160*	3,425	4,277	4,613	4,950	5,306
Baggage Handling Area (SF)	*3,428*	3,400	3,400	3,400	3,400	3,400
Rental Car Area (SF)	*3,310*	2,748	2,748	2,748	3,435	3,435
Sterile Area Restrooms	*23*	8	8	9	9	9
Public Area Restroom	*24*	10	11	11	12	13

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

Passenger terminal building facility recommendations include the following:

- **Improve the rental car exit vestibule to allow a wider, more direct corridor for rental car customers.**
- **Provide additional self-service check-in kiosks in the ticketing lobby for added customer convenience.**
- **Install an in-line baggage screening system to increase throughput and allow ticket counter space to be used exclusively by airline personnel.**

- **Restructure baggage make-up area when in-line baggage screening is installed to improve capacity.**
- **Expand concessions in the sterile area as major improvements or expansion of the concourse is made.**
- **Add an additional security screening lane within the existing space as demand may require it within the planning period.**

Apron

Terminal Apron

The primary purpose of the terminal apron is to provide parking for commercial passenger aircraft at the terminal gate and provide circulation space for aircraft and airline support functions. There are 7 passenger boarding bridges and 9 parking positions around the terminal gate.

The primary driver for the size of a terminal apron is the terminal building. The building layout and configuration will drive the size and space needs for the apron. The terminal apron size and configuration is a function of the total number of gates, building configuration, aircraft type, airfield configuration, aircraft maneuvering and FAA design standards including wingtip clearances. As the terminal building concepts are developed, software will be utilized to model gate configuration which will help identify the required terminal apron size. Gates should be designed to provide adequate space for taxi-in and pushback-out operations.

The terminal apron should be sized to accommodate regular use of larger aircraft as identified in the gate space requirements. Known existing considerations to the terminal apron size include deicing operations along Taxiway T-1, narrowed apron depth for Gates 2 and 4 which from the terminal are 210 and 250 feet respectively, and deicing truck parking. The apron near Gate 2, the narrowest position, also accommodates parking for deicing trucks for the airlines. The remainder of the gates range from 300 to 350 feet in apron depth. Currently aircraft parked at Gate 2 must be pushed back to behind Gate 7 before being released to taxi. The west portion of the apron, which is narrowest, is bounded on the landside by a road and parking for rental cars. There are no structures that would impede expansion of this apron.

Remain Overnight Parking (RON)

There is currently no designated RON parking apron at Rapid City. Commercial aircraft typically park overnight at the terminal gates. There are currently 9 aircraft parking stands surrounding the terminal building accommodating aircraft ranging from a CRJ-200 to a Boeing 757. All 9 aircraft can connect to a passenger boarding bridge depending on aircraft size. The March 2014 flight schedule shows there are 5 RON aircraft (1 Bombardier Q400, 1 Embraer ERJ-145 and 3 CRJ-200 aircraft) during weekdays and the July 2014 flight schedule shows 7 RON aircraft (2 Airbus A319, 3 Embraer ERJ-145 and 2 CRJ-200 aircraft).

Deicing Apron

Aircraft deicing is necessary prior to departure in cold weather conditions. Deicing operations are currently accomplished on the existing aircraft apron along taxilane T-1 which can accommodate only one aircraft at a time. An ADG II aircraft can be deiced while an ADG III aircraft taxis on T-1. If an ADG III aircraft is being deiced then T-1 is restricted to no larger than an ADG II aircraft. Since there is just one position this creates delay as aircraft gate pushback and deicing operations can last approximately 15 minutes.

Aircraft deicing pads should be located in reasonable proximity to the departure runway. A location near the terminal apron should be explored or deicing at each airline gate should be explored.

Deicing facilities need to have space for aircraft and wingtip clearance, as well as space for mobile equipment maneuvering, a bypass taxiway, appropriate runoff mitigation to meet environmental requirements, lighting and support facilities. **A consolidated RON apron and deicing facility should also be considered.**

Ground Equipment Storage

Airlines operate their own ground service equipment (GSE), including a variety of aircraft tugs, pushbacks, service vehicles, deicers, ground power units (GPUs), baggage belt-loaders, and other support vehicles. GSE is currently stored outdoors clear of critical areas, under the concourse in open and garaged space and inside the baggage make-up corridor behind the airline offices.

Air Cargo

Rapid City is a destination airport for air cargo flights mostly from Sioux Falls, SD sometimes with an interim stop at Pierre, SD. FedEx, UPS and USPS serve the airport through various feeder airlines which connect to Sioux Falls. Cargo is processed on Apron AP-5 adjacent to Taxiway T-1 for FedEx and USPS and on Apron AP-1 for UPS. Total enplaned and deplaned air cargo is forecasted to grow a total of 48 percent through PAL 4. There is minimal belly cargo carried by the airlines.

The air cargo operations at Rapid City occur in the morning and early evening for FedEx and UPS and occur in the late evening only for USPS to meet delivery schedules. Cargo is loaded and unloaded on the apron areas.

During the Sturgis Motorcycle Rally there is additional cargo demand and UPS has a flight directly from Sioux Falls to Spearfish SD to meet this demand. The reason is not because of lack of space at Rapid City, but to limit ground vehicle travel going to Sturgis SD during the congested time of the rally. Spearfish's Black Hills Airport (SPF) is 17 miles west of Sturgis as compared to Rapid City Regional Airport (RAP) which is 41 miles east of Sturgis.

The Apron AP-5 area will likely be lost for air cargo as the old terminal is removed and a new FBO terminal is constructed adjacent to Apron AP-4 and Apron AP-4 is expanded to connect with Apron AP-6. There is a need to have sufficient apron for FedEx to park through the day and the UPS carriers typically hangar their aircraft during the day to avoid deicing. The apron area for air cargo needs close access to roadways to minimize movement of cargo trucks on the airside and it needs to be conveniently located for services needed for the aircraft such as storage, fueling and deicing.

The apron needs will be based on estimated fleet mix. Current fleet mix includes:

- Zero ADG-I air cargo aircraft unless replacing an ADG-II aircraft
- Two ADG-II air cargo aircraft (1 UPS, 1 USPS)
- One ADG-III FedEx ATR-42 air cargo aircraft

It is estimated cargo aircraft will increase at PAL 4 about 46 percent over the base scenario. Size requirements were calculated for each design aircraft using calculated clearances from other aircraft, objects and an assumed taxilane. An additional 10 percent is added for Ground Support Equipment (GSE).

- Airplane Design Group I – 1,000 square yards per aircraft
- Airplane Design Group II – 2,400 square yards per aircraft
- Airplane Design Group III – 3,300 square yards per aircraft

The apron should be designed to FAA standards so that sufficient space for parking, circulation and ground operations. Expansion concepts will be developed in the following chapter.

Table 4-42 – Air Cargo Apron Requirements

Air Cargo Apron Requirements						
Category	***Existing***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Cargo Aircraft						
Design Group I	-	-	-	-	-	-
Design Group II	*1**	1*	1*	2*	1*	1*
Design Group III	*1*	1	1	1	2	2
Total	*2*	2	2	3	3	3
Cargo Apron Space (SY)						
Design Group I	-	-	-	-	-	-
Design Group II	-	2,400	2,400	4,800	2,400	2,400
Design Group III	-	3,300	3,300	3,300	6,600	6,600
Total Space	*0*	5,700	5,700	8,100	9,000	9,000

**USPS aircraft is not added since it operates at a time when the other aircraft have already departed the airport. Red indicates a deficiency to existing facilities.*
Source: KLJ Analysis

Recommendations

The Air Cargo needs are as follows:

- **Establish an area of apron and associated buildings for air cargo with sufficient airside and landside access. The facility should be sized to meet the requirements in PAL 1 (5,700 SY) with expansion capability through PAL 4 (9,000 SY).**
- **Locate the cargo apron area so that there is flexibility to either store aircraft in hangars in the area or conveniently tow aircraft for storage in other hangars.**

General Aviation

General Aviation includes all civil aviation activities except for commercial service. GA covers a much broader portion of the aviation community. GA activities found at Rapid City include corporate travel, medical transport, flight training, personal and business flights as well as recreational flying. These types of aeronautical activates serve the public in a capacity that may be less noticeable to the average citizen. Providing facilities and access for GA users at Rapid City will continue to be vital for the community and region.

Rapid City Regional Airport continues to serve as the primary GA facility for the community handling the vast majority of corporate business traffic. There are 111 based aircraft and over 22,500 annual flight operations classified as GA. Based aircraft is projected to grow 38 percent with operations growing by 55 percent through the planning period. GA facilities are necessary to support these operations on the airfield. On-airport businesses providing aeronautical services known as Fixed-Base Operators (FBOs) and Specialized Aviation Service Operators (SASOs) provide aircraft maintenance, fueling and other pilot and passenger services.

The following Table identifies the PAL metrics for the General Aviation.

Table 4-43 – General Aviation Planning Activity Levels (PALs)

General Aviation Planning Activity Levels					
Metric	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Based Aircraft					
Single Engine	70	75	75	86	91
Multi-Engine	31	34	36	43	47
Jet	8	10	11	13	15
Helicopter	1	1	0	0	0
Other	1	1	1	1	1
Total Based Aircraft	111	121	125	143	154
General Aviation Operations					
Local Operations	7,593	8,604	9,750	10,698	11,941
Itinerant Operations	14,997	16,153	17,878	20,216	23,102
Total Operations	22,590	24,757	27,628	30,914	35,043
General Aviation Peak Transient Operations					
Peak Month Transient Operations	1,079	1,162	1,287	1,455	1,662
Design Day Transient Arrivals	24	26	28	32	37
Transient Aircraft Parked on Apron	19	21	23	26	29

Source: KLJ Analysis

Aircraft Storage

Aircraft storage requirements are driven by the aircraft size, local climate and owner preferences. Aircraft are becoming increasing more complex and expensive. The overall trend is for larger turboprop and corporate business jet aircraft to operate at the Rapid City Regional Airport. The harsh winters in the upper Midwest drive all owners to seek aircraft storage facilities rather than outdoor parking on an aircraft parking apron. Owners prefer to have covered, secure storage for their aircraft with space for other aeronautical facilities including an office or maintenance/storage areas. Nearly all the based aircraft at Rapid City are stored in covered storage facilities.

A facility space model was developed using the based aircraft forecast, estimating a hangar type preference and applying space per aircraft. The Rapid City based aircraft forecasts estimate another 43 based aircraft through the planning period (PAL 4) consisting of 21 single-engine, 16 multi-engine and 7 turbojet aircraft.

Aircraft are currently stored in approximately 259,000 square feet of aircraft storage space. There are three main hangar types identified:

- T-Hangar: Nested small aircraft storage units
- Small Conventional Hangar: Private aircraft storage or Commercial aeronautical use of 8,000 square feet or less
- Large Conventional Hangar: Private aircraft storage or Commercial aeronautical use of more than 8,000 square feet

The following assumptions were made about aircraft storage space requirements:

- T-Hangar: 1,200 square feet per aircraft; 85% single-engine, 15% multi-engine aircraft
- Small Conventional Hangar: 3,000 square feet per aircraft; 15% single-engine, 40% multi-engine, 25% turbojet aircraft
- Large Conventional Hangar: 3,600 square feet per aircraft; 45% multi-engine, 75% jet aircraft
- An additional 20 percent of the building is added for hangar to be used for other aeronautical purposes including maintenance and transient aircraft storage.

Using these assumptions with based aircraft forecasts, a projected need for aircraft storage space is determined. It is important to understand that this projection provides a broad estimate of needed space into the future for facility planning. Actual space needs are demand-driven.

Table 4-44 - Aircraft Storage Requirements

Aircraft Storage Requirements						
Category	***Existing***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Hangar Space						
T-Hangar	*72,710*	85,350	91,800	92,700	107,520	113,970
Small Conventional	*80,083*	57,000	63,300	66,600	79,980	86,280
Large Conventional	*106,375*	104,610	118,500	125,820	150,900	164,790
Total	*259,168*	246,960	273,600	285,120	338,400	365,040
Capacity/(Deficiency)	-	12,208	(14,432)	(25,952)	(79,232)	(105,872)

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

Of the existing T-Hangar space, 38,060 square feet (27 of the existing units) is scheduled for demolition in the next 4 years. Because of the condition of these existing units many are not currently occupied and single engine aircraft are being stored in larger hangars. The most critical deficiency at PAL 1 therefore will be a need for 57,000 square feet of new T-Hangar space (approximately 45 units).

One important issue with hangar construction in the General Aviation area is the current limited fire flow. While improvements have been made in the water supply and fire flow to the airport, the general aviation area is still limited due to small water lines through the area. Phased replacement of these water lines with higher capacity lines should be completed to allow additional hangar construction without having to increase setbacks or implement additional preventative measures.

All other requirements for hangar space will be demand driven and it is recommended that space be allocated in airfield alternatives so that expansion can occur in each area of need

without negatively affecting any other area. This facility requirement analysis shows there is a need for about 51 percent more hangar space at Rapid City through PAL 4.

Aircraft Parking Apron

At airports general aviation aircraft parking is used by both itinerant and based aircraft. At Rapid City Regional Airport nearly all based aircraft are stored in hangars, and most of the aircraft parking area is for itinerant aircraft for a short period of time ranging from a few minutes to a few days. The design day aircraft operations that use GA facilities were evaluated to determine the total apron size requirements at Rapid City during the peak month. Itinerant aircraft in these aircraft operations require apron parking space. The apron size is driven by the number and size of aircraft. The purpose of this analysis is to determine the triggering point for additional GA apron space using the aviation activity demand forecasts.

Assumptions include:

- Transient operations are 70 percent of itinerant operations, conducted by non-local users.
- Peak month (10.28 percent of annual operations) and design day (4.41 percent of monthly operations) are based on the aviation forecasts.
- An operation is an arrival or a departure.
- Apron space will be needed by 80 percent of arriving transient aircraft, with the remaining 20 percent requiring hangars.

Table 4-45 – Transient Apron Aircraft Requirements

Transient Apron Aircraft Requirements						
Category	***Existing***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Operations						
GA Itinerant	-	14,997	16,153	17,878	20,216	23,102
Apron Aircraft						
Transient Operations	-	10,498	11,307	12,515	14,151	16,171
Peak Month Ops.	-	1,079	1,162	1,287	1,455	1,662
Design Day Ops.	-	48	51	57	64	73
Design Day Arrivals	-	24	26	28	32	37
Apron Aircraft	-	19	21	23	26	29

Source: KLJ Analysis

Itinerant airport operations included 26.6 percent single/multi-engine piston and helicopters, 54.2 percent turboprop and 19.2 percent business jet. The aviation forecasts were utilized to project future fleet mix. Aircraft types were then split by Airplane Design Group (ADG) classification to determine the necessary parking area with required FAA setbacks. Size requirements were calculated for each design aircraft:

- Single/Multi-Engine Piston (ADG-I) – 800 square yards per aircraft
- Turboprop (ADG-II) – 2,000 square yards per aircraft

- Business Jet (ADG-II) – 2,000 square yards per aircraft (98% of business jet operations)
- Business Jet (ADG-III) – 4,100 square yards per aircraft (2% of business jet operations)

Additionally, total space requirements also assume 10 percent of the based aircraft are located on the apron for transient purposes.

Based on this assessment, the existing apron is sufficient to accommodate the project needed through the planning period. Reconstruction of the north general aviation apron will be necessary within the planning period. Any future apron should be designed to FAA standards so there is sufficient space for the design aircraft (ADG II, III) parking and maneuvering.

Table 4-46 – Total Apron Space Requirements

Total Apron Space Requirements						
Category	***Existing***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Aircraft						
Single/Multi Engine Piston	-	12	13	13	15	16
Turboprop	-	13	15	16	18	21
Turbojet	-	4	5	6	7	8
Total	*31*	30	32	35	40	45
Capacity/(Deficiency)	-	1	(1)	(4)	(9)	(14)
Apron Space (SY)						
Single/Multi Engine Piston	-	9,654	10,299	10,686	12,094	13,145
Turboprop	-	26,832	29,022	31,796	36,612	41,183
Turbojet	-	10,321	11,558	12,957	14,965	17,366
Total Space	*60,331*	46,807	50,880	55,438	63,671	71,693
Capacity/(Deficiency)	-	13,524	9,451	4,893	(3,340)	(11,362)

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

This evaluation combines total apron space. At Rapid City there is one general aviation apron area. The area is designed to meet ADG-II requirements with a pavement strength of 90,000 lbs. As Taxiway A has been straightened the apron has been expanded east to allow the maximum amount of apron close to Taxiway A. In addition, the old Airline Terminal is being removed and the apron will be reconstructed and expanded in this southern area. The northern portion of the apron has not been expanded and reconstructed like the other areas and should be completed as funding allows.

On the general aviation apron a roadway exists approximately 60 to 90 feet from the hangars facing the apron. In the site visits of the airport and in feedback from several tenants many aircraft were seen parked across this roadway. Airport staff indicated this was an ongoing problem. Since the current location of this road is within a prime location for aircraft parking it is recommended the roadway location be reconsidered by the airport to one that is more functional for tenants and aircraft. The roadway should either be much closer to the hangars or well beyond the typical parking area for aircraft but its current location in the middle of this parking area is problematic. The best timing to consider this will be after the old

terminal is removed in early 2015 and the apron in the area is reconstructed. It is important to note that the location of a marked road may at times use taxilanes rather than adding roadway markings. This is important to consider and the information is noted again in the section of this chapter regarding roadways.

Recommendations

The General Aviation needs are as follows:

- **In PAL 1 construct 57,000 square feet of new T-Hangar space (approximately 45 units) to meet demand and replace 38,060 square feet (27 units) of existing dilapidated hangars.**
- **Replace smaller water lines in General Aviation area to increase fire flow.**
- **Identify development areas for as much as 40% more hangar space with a variety of sizes. T-hangars and large conventional hangars are those that are expected to be in in the greatest demand. Small conventional hangars less than 6,000 square feet are not expected to have as great a demand. Development must include sufficient airside and landside access suitable for the types of hangars.**
- **Repair and expand the north general aviation apron area to match the alignment of the recently improved portions of the general aviation aprons.**
- **Relocate the roadway across the general aviation apron area to both allow typical aircraft parking and ensure a safe route for vehicles in the non-movement area.**

Landside Facilities

Terminal Curbside

The terminal building at Rapid City is served by one curbside area adjacent to the arrival and departure areas. There are a total of five lanes, two parking and three driving, providing access to the terminal area to pick-up and drop-off passengers:

- Lane 1 – Direct curbside access next to the terminal building providing 520 linear feet of capacity for personal vehicles, taxis and shuttles.
- Lane 2 – Lane used for vehicle circulation. During peak hours Lane 2 can be used as a secondary curbside area for passenger pick-up and drop-offs where double-parking is observed. These are operations are typical even for LOS C standards.
- Lane 3 – Dedicated vehicle through lane for those entering and existing the inner curbside area.
- Lane 4 – Outer curbside access for other vehicles, typically busses. This portion has 440 linear feet of capacity for vehicles.
- Lane 5 - Dedicated vehicle through lane for the outer curbside area vehicles.

Total inner and outer curbside length each is a total of 960 linear feet less pedestrian walkways.

Terminal curbside needs are evaluated using industry planning criteria to determine linear frontage for the curb to meet LOS standards. A planning factor of about 0.40 vehicles per peak hour total passengers based on factors developed from typical vehicle movements. A dwell time of 5 minutes was used for personal vehicles at Rapid City assuming unloading, loading or waiting times. Industry standard vehicle lengths were used to determine curbside length requirements based on demand. The individual peak 15 minute period represents 35 percent of the design hour vehicles which is a conservative estimate.

Table 4-47 – Curbside Requirements

Curbside Requirements						
Category	***Exist.***	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Lane 1 Inner Curbside						
Personal Occupancy Vehicles	*69*	69	86	93	100	107
Taxis/Limousines	*4*	4	6	7	7	8
Shuttles	*3*	3	3	3	4	4
Curbside Length	*520*	172	214	232	249	266
Lane 4 Outer Curbside						
Taxis/Limousines	*4*	4	6	7	7	8
Shuttles	*3*	3	4	5	5	5
Commercial/Other Vehicles	*2*	2	2	2	2	2
Curbside Length	*440*	160	199	215	231	247

Source: KLJ Analysis

As enplanements increase at the airport, so will the number of vehicles occupying the terminal curbside. The curbside length at Rapid City is projected to be adequate for LOS C standards with no lanes approaching capacity within the planning period. Dwell times for Rapid City are very generous and if curbside congestion begins to occur it is recommended that dwell times be reviewed for different classes of vehicles. As activity increases there will be additional peak periods where double-parking occurs on the inner curbside. These operations are deemed acceptable for LOS C standards but may not meet customer expectations at Rapid City.

Automobile Parking

The automobile parking needs at a commercial service airport directly relates to the number of annual enplaned passengers. Automobile parking types include public, employee and rental car parking.

Existing automobile parking supply is summarized in the table below. The airport reconfigured the main parking lots when the terminal was constructed an expanded portions in parking lot in 2010. This increased parking capacity by about 150 spaces. The number of effective parking spaces was determined. This figure assumes 95 percent of the actual supply of spaces is available to the public due, maintenance or snow removal or for circulating parkers to find an available stall. The effective space count will be used for planning purposes.

Table 4-48 – Automobile Parking Supply

Automobile Parking Supply		
Parking Category	**Actual Spaces**	**Effective Spaces (95%)**
Public Parking		
Gravel Cell Phone Lot	14	14
Short-Term Lot	312	296
Long-Term Lot	709	674
Total Public Parking	1,035	984
Employee Parking		
South Employee Lot	27	27
Total Employee Parking	27	27
Rental Car Parking		
Ready-Return Lot	340	323
Remote Gravel Storage Lot	140	133
Total Rental Car Parking	480	456
Total Parking Spaces	1,542	1,467

Source: KLJ Analysis

Public Parking

Public parking includes cell phone, short-term and long-term parking lots at Rapid City. This analysis combines all public parking needs into a cumulative review. The need for public parking spaces is driven by passenger enplanements in the peak day of the peak month.

Public parking demand is projected using the 2.10 spaces per 1,000 annual enplanements ratio projected through the planning period. The forecasted demand is within the available capacity through the planning period with 123 spaces of capacity through PAL 4.

Table 4-49 – Public Parking Requirements

Public Parking Requirements					
Category	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Enplanements	256,191	275,634	296,254	318,133	341,298
Public Parking Demand (with 20% daytime accumulation)	646	695	747	802	860
Effective Public Parking Supply	984	984	984	984	984
Capacity/(Deficiency)	338	289	237	182	123

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

Rapid City provides a cell phone and waiting lot with 14 total spaces. These spaces should be sufficient through PAL 4.

Employee Parking

Employee parking is comingled with the short term and long term public parking The majority of employee parking needs are therefore considered with the public parking needs. There is also a 27 stall south lot used by some airline and airport personnel. The existing capacity will meet the needs through PAL 4.

Table 4-50 – Employee Parking Requirements

Employee Parking Requirements					
Category	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Employee Parking Demand	10	11	12	13	14
Effective Employee Parking Supply	26	26	26	26	26
Capacity/(Deficiency)	16	15	14	13	12

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

Rental Car Parking & Facilities

Rental car parking needs include ready/return lots for customers near the terminal, and long-term storage lots where the rental car fleet can be stored. Facilities with the parking areas include a quick-turn facility for rental car companies to clean and maintain vehicles. Each of the four car rental concessionaires at Rapid City will have different facility needs. Car rental facility requirements are evaluated cumulatively.

Ready/Return Parking

Ready/return parking needs correlates with the peak number of customer transactions rather than the total number of customers. Increased demand requires rental car staff to transport cars to/from the storage lot more frequently placing additional costs and demands on their operation. This parking lot should be located immediately adjacent to the rental car counters as is the case with the present location at Rapid City. There are currently 323 spaces occupying a total space of 3.4 acres.

Table 4-51 – Rental Car Ready/Return Parking Requirements

Rental Car Ready/Return Parking Requirements					
Category	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Peak Hour Transactions/Demand		221	237	255	273
Effective Ready/Return Supply	*323*	*323*	*323*	*323*	*323*
Capacity/(Deficiency)		102	86	68	50

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

The calculation shows there is sufficient space during the peak period. The observations are however that the ready/return lot does exceed capacity because of insufficient space for rental car storage.

Rental Car Storage

The size of the rental car storage lot is directly tied to the total rental car fleet. Total fleet is directly attributed to the total number of arriving passengers requiring rental cars. Rental car companies were queried to determine their peak parking needs. Car deliveries, or "ramp-up" occurs during the summer and late October through late November. There is not sufficient space using the ready return and storage areas to handle the ramp-up periods. Between all

rental car agencies there is an estimated need to store 300 cars that are delivered to Rapid City, in addition to the existing fleet, to prepare for peak rental car activity. Since there is a current surplus of long term public parking through the planning period and the "ramp-up" period is outside of the peak enplanement period, it would be possible to use a distinguishable portion of the public parking lot for rental car storage.

Table 4-52 – Rental Car Storage Parking Requirements

Rental Car Storage Parking Requirements					
Category	**Base**	**PAL 1**	**PAL 2**	**PAL 3**	**PAL 4**
Typical Rental Car Storage Demand		303	326	350	375
Effective Rental Car Storage Supply	*133*	*133*	*133*	*133*	*133*
Capacity/(Deficiency)		(170)	(193)	(217)	(242)

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

A permanent parking solution to add space for ready return and storage should be included in the airport alternatives. These parking expansions could then be added as demand dictates.

Quick Turn Facility (QTF)

A facility to accommodate rental car operations is a maintenance or "quick-turn" facility. These facilities are located within the vicinity of rental car operations and parking. A typical rental car QTF consists of a car wash, maintenance bays, storage and fueling area. The existing rental car QTF was completed in 2014 and is located within the rental car parking area. Total space is approximately 9,800 square feet of total space two car washes, five maintenance bays and a fueling area with underground storage tanks. The airport constructed the QTF and revenues from car rental agencies are used to pay for its operation. The QTF will meet the existing need though PAL 4.

Recommendations

Automobile parking facility recommendations for Rapid City include:

- **Provide additional parking particularly for rental car storage. It is possible in the short term to use some portions of public parking for rental car storage but this area will not be adequate for the long term.**
- **Be cognizant of any additional need for the cell phone waiting lot. It is yet to be determined how well this lot is serving passengers' needs particularly as it is unpaved and not well known.**

Ground Access & Circulation

Passenger Terminal Complex

Access to the passenger terminal complex is provided by Airport Road and Terminal Road from State Highway 44. There is one entrance and exit. All vehicle traffic for the terminal complex is guided to the terminal via Terminal Road. This includes passenger vehicles, busses, taxis, shuttles and rental cars. The rental car area is accessible from general aviation road immediately north of the terminal complex.

As passenger volumes increase so will the traffic count and flow through the terminal complex. The existing ground access and circulation infrastructure is adequate through the planning period.

Roadway System Considerations

Surrounding roadways provide adequate access for customers to and from the airport. Roadway plans can also influence airport development. The only access roadway for Rapid City is State Highway 44. This roadway provides direct connection to the Rapid City central business district which is 11 miles from the airport terminal building. The airport property is within 4 miles of Interstate 90 but is 10 miles by road.

Interstate Access

There is no direct access point from the local interstate system to the airport.

Long View Road around Runway 14 and 23

Currently the Runway Protection Zone (RPZ) for Runways 14 and 23 have public roads traversing through the RPZ. Under recent FAA policy if the runway thresholds were to change or the instrument approaches were to change, these roads would need to be realigned so that they are outside of the RPZ. It is recommended that the instrument approach to Runway 14 be improved. This will require Long View Road to be realigned outside of what will be a larger RPZ for Runway 14.

Public Transportation

There is no public transportation access to Rapid City to serve passengers or airport employees. State Highway 44 is not served by fixed route service on the Rapidride system. The closest bus stop is at the corner of State Highway 44 (Omaha Street) and Centre Street adjacent to Western Dakota Technical Institute approximately 8 miles from the airport terminal. It is recommended the Airport work together with the Rapidride to determine any need for service to the airport.

Support Facilities

Support facilities are necessary to support a safe and efficiently run airport supporting airport operations and the travelling public.

Fueling Facilities

The airport has one Fixed Base Operator and a Specialized Aviation Service Operator that sells fuel. Each operator has their own dedicated fuel farms with Jet-A and 100 low lead (LL) aviation fuel types. The combined privately owned fuel tanks have a 50,000 gallon capacity of Jet-A fuel and 25,000 gallons capacity of 100LL fuel.

The fuel tanks for the FBO, WestJet are located in a fuel farm area west of the general aviation area. The area can be expanded but is currently situated in an area that would be well suited for hangar development. An alternative location for the fuel farm with expansion capability will be considered in the airfield alternatives. The fuel tanks for the SASO, Rapid Fuel are self-fueling tanks on the apron.

Each fuel farm should provide capacity for two-week usage and be sized for a full tanker truck. Overall 100LL airport operations are forecast to increase 35 percent through PAL 4, with Jet-A operations increasing 19 percent. There are plans within the aviation industry for a replacement fuel for 100LL. If it is possible to completely replace this fuel so that existing aircraft can use the new fuel then it may be possible to convert the 100LL tanks to use for the new fuel. If it is not possible for existing aircraft to use the new fuel, then it will be necessary to maintain three types of fuel at the airport for general aviation aircraft.

There will be the need for additional fuel storage as demand occurs. Considerations should also be made to encourage the use of alternative fuels through accommodating additional storage. Additional fuel tanks and facilities will be constructed as demand arises. There is expandable space to meet the needs through PAL 4 at Rapid City.

The SDARNG also maintains JP-8 fuel tanks with 25,000 gallons of capacity. This tank capacity is dedicated to the needs of the National Guard and not otherwise available for the public.

The airport currently has diesel and unleaded fuel for airport maintenance equipment. The total storage capacity is 30,000 gallons of diesel and 30,000 gallons of unleaded. This fuel farm is located with the current WestJet fuel tanks. An alternative location will be considered with the airfield alternatives.

Aircraft Rescue and Fire Fighting (ARFF)

As a certificated FAR Part 139 facility, Rapid City must comply with ARFF equipment, staffing, training and operational requirements. The airport owns and operates the ARFF facility with City of Rapid City Fire Department staff on the north side of the terminal building. This facility, Station 8, was completed in 2011 and its operation meets all FAA requirements.

ARFF requirements are driven by the length of the largest air carrier aircraft that serves the airport with an average of five or more daily departures. Rapid City is currently classified as an ARFF Index B facility. Future anticipated operations would regularly be conducted in a Boeing 717 (124' 0" length) aircraft. The ARFF index is not anticipated to change into the future.

Table 4-53 – ARFF Index Requirements

ARFF Index Requirements		
ARFF Index	**Aircraft Length**	**Representative Aircraft**
A	< 90 feet	Beech 1900D
B	90 feet - < 126 feet	CRJ-900, A-320, ERJ-145
C	126 feet - < 159 feet	B-737-800, B-757, MD-80
D	159 feet - < 200 feet	B-767, A-300
E	> 200 feet	B-747

Source: Title 14 CFR Part 139

The ARFF station must be located so that at least one firefighting vehicle can reach the midpoint of the farthest runway serving air carrier aircraft within three minutes and the remaining firefighting vehicles reaching this same midpoint within four minutes. The current ARFF site meets this requirement. With no major airfield configuration changes anticipated, this location will be sufficient to meet the needs into the future.

Airport Maintenance & Snow Removal

The airport maintenance complex is located at Airport Road and La Croix Court in the General Aviation area. Total facilities consists of 22,400 square feet of offices, maintenance, storage and shop space in four different buildings. Some of the buildings are old and in need of repair. The complex is generally adequate but is located in an area with prime access for general aviation development. Relocation of these facilities to make space for general aviation development should be pursued in PAL 1.

Winter operations require the removal of snow and ice from the airfield to maintain airport operations. Snow removal equipment is stored in the airport maintenance building. Snow needs be cleared from the pavement surfaces, around airfield lights and signs. Piled snow should not create a visible obstruction to pilots. It should be piled in a location that does not impede airport operations and can sufficiently melt and adequate drainage. There are no known snow removal or storage issues at Rapid City. Future facilities should provide adequate clear space for snow removal storage.

Customs and Border Protection (CBP)

The Rapid City community has investigated the prospects of a CBP facility at the airport to accommodate general aviation activity. The purpose would be to handle aircraft coming to Rapid City as a destination from an international location, most likely Canada or Mexico. It would also be for the purpose of handling aircraft coming into the United States who would be more conveniently served on their route by clearing customs at Rapid City as compared to the location they actually used. Both of these types of users would be important to make a CBP facility most cost effective. In regards to the routed flights, the actual flight records of 31,429 international flights from 2008 through 2013 were examined in the region. Of these flights approximately 4% or 200-250 flights per year could benefit from routing through Rapid City as compared to the location they choose to clear customs through. Rapid City could easily entice more of the international flights depending on outreach marketing and whether Rapid City would be more convenient for a fuel stop than other locations. These attributes were not examined.

Since there is interest in the community to establish a CBP facility for general aviation, a location for such a facility will be included in the airfield alternatives analysis. This separate long-term GAF facility would be approximately 3,000 square feet plus vehicle and airside access. The facility can also be established near a cargo area in the event international cargo might be explored in the future.

Table 4-54 - Customs and Border Protection (CBP) Space Requirements

Customs and Border Protection (CBP) Space Requirements	
Area Type	**Square Feet Required**
General Aviation Facility (GAF)	
Passenger Waiting and Processing	2,160
CBP General Office	225
Computer/Communications Room	60
Storage Room	60
Search/Hold Room	80
Interview Room	80
Agricultural Quarantine Inspection (AQI) Laboratory	110
Public Restrooms	112
TOTAL	**2,892**

Source: Airport Technical Design Standards for Passenger Processing Facilities (USCBP, 2006)

Security & Access

Security is an important consideration when operating a safe airport. Transportation Security Administration (TSA) publishes recommended airport design guidelines. The first line of security protection infrastructure is a perimeter fence. Its installation will help prevent unauthorized persons from entering the airfield and also to control wildlife. A minimum 6-foot high fence with added barbed wire is recommended by TSA with upgraded FAA standards recommended to control wildlife. At Rapid City the perimeter fence is sufficient to meet the security and wildlife requirements of the airport and should be maintained to all TSA and FAA standards. All access points are controlled.

The TSA recommends a 300 foot bomb blast separation from public parking to the passenger terminal. If this is not possible, the TSA recommends an analysis be completed to determine if a reduced distance will be acceptable. Rapid City currently has less than a 300 foot separation and a study was completed to determine if this was acceptable. The study determined it would be acceptable for Rapid City and certain specific measures were taken to improve the security of the terminal. These measures are not included as they were determined to be security sensitive information.

FAA generally recommends airports have a full internal access road system that allows authorized vehicles to access various portions of the airfield, minimizing the need to navigate on taxiways, cross runways or leave the boundaries of airport property. A typical perimeter road is 20 to 24 feet wide and located outside of the airfield safety areas. Rapid City uses aprons and taxilanes for traversing the east side of the airport. This is the most heavily traveled area of the airport and keeps vehicle activity off of runways, taxiways and most aircraft movement areas.

A portion of this roadway is on the general aviation apron approximately 60 to 90 feet from the hangars facing the apron. In the site visits of the airport and in feedback from several tenants many aircraft were seen parked across this roadway. Airport staff indicated this was an ongoing problem. Since the current location of this road is within a prime location for aircraft parking it is recommended the roadway location be reconsidered by the airport to one that is more functional for tenants and aircraft. The best timing to consider this will be after the old terminal is removed in early 2015 and the apron in the area is reconstructed. It is important to note that the location of a marked road may at times use taxilanes rather than adding roadway markings.

An unpaved perimeter road exists around all of the airport. This road is used to access navigational aids and the perimeter fence. As opportunity arises, the unpaved portions of the perimeter road should be paved beginning with those roads nearest to aircraft movement areas and those used to access navigational aids.

Airport Utilities

On-airport utilities including power, communications, natural gas, sanitary sewer, water and storm sewer are discussed in this section. Future facility development may require the relocation, replacement and/or upgrading of portions of the airport utility infrastructure.

The utility services for electrical power, communications and natural gas were determined to be sufficient to meet the existing and projected needs of the airport on the west side. If development were to occur on the east side of the airport, there is limited utility service and new utilities of adequate size will need to be added.

The airport maintains its own system for storm sewer purposes. This system is considered to be adequate for the needs of the airport in the planning period.

Water service from the City of Rapid City exists at the airport. The current service is a 12" water main connecting to the airport at Airport Road and RTR road. It also includes a looped water main along Taxiway A which added capacity to provide 1500 gallons per minute of fire flow near the terminal. The water service is planned for improvement with a new water main connection from the north on the west side which will provide additional capacity to meet fire suppression requirements. With the improvements it is estimated that there will be 4000 gallons per minute of fire flow near the terminal. As noted earlier, the fire flow in the General Aviation area will still be limited until smaller water lines are replaced.

The Sanitary Sewer system at the airport uses an existing lagoon system for treatment. The lagoon is located on the west side of the airport and is estimated to be inadequate for the airport within the planning period. A sanitary sewer connection to the City of Rapid City's system is being planned. The current city treatment facility is 2 miles directly southwest of the airport on the south side of State Highway 44. The connection will require a lift station and that lift station will either be directly south of the airport or further east of the airport along State Highway 44. The location has not be determined and no timeline or funding plan has been established for the connection of the airport to the city's sewer treatment plant.

Other

Military Facilities

The military facilities at Rapid City support the South Dakota Army National Guard (SDARNG). SDARNG leases approximately 30 acres of land from the Airport for both aeronautical and non-aeronautical facilities. The scope of this Master Plan related to the military is limited to planning the appropriate location on the Airport for military area requirements, as determined by the military.

Ongoing coordination between the Airport and SDARNG will ensure that facilities remain sufficient for current and future military operations. Space for potential future expansion of these military facilities should be factored into the long-term, on-airport land use planning.

USFS Facilities

The United States Forest Service (USFS) maintains an air tanker base at the airport. There is a long term need to maintain such a facility at the airport. The size and layout of the current air tanker base is not adequate to meet the needs of the USFS and improvements should be made as early as practicable. The current facility sees C-130 aircraft as the largest but these aircraft can only enter one at a time because the loop taxilane is not separated from the perimeter fence and other taxilane enough for two aircraft to be in the loop at one time. As early as the summer of 2015, the USFS expects to have MD-87 aircraft conducting tanker operations. These MD-87 aircraft cannot maneuver through the existing air tanker base. The USFS improvements should be sufficient to handle multiple aircraft as large as the MD-87 and DC-10. These aircraft and others are being configured for use in aerial firefighting.

Since the SDARNG and USFS facilities are funded by the state and federal government the improvements are generally not eligible for funding from the FAA through the Airport Improvement Program. Funding for these improvements to the SDARNG must come from other state or federal funding sources or may come from the airport through long term leases and thus annual payments for the improvements.

Other Aeronautical/Non-Aeronautical Development

Other aeronautical development includes aviation-related businesses. Examples include aircraft maintenance, repair and overhaul (MRO) facilities or other businesses that require direct access to the airfield. Considerations for developing property for these uses include adequate airfield access, parcel size, landside roadway access/parking and utilities. This type of development should be protected if sufficient available land exists.

Airports should primarily be reserved for existing and planned aeronautical uses, however, non-aeronautical uses can enhance the customer experience and provide additional revenue-generation opportunities to the airport. If airport owned land does not have any aeronautical need for the safety, capacity or other airport development needs then it can be considered for a non-aeronautical use. Non-aeronautical development requires a concurrent land use or land release with approval from the FAA.

Examples of non-aeronautical land uses at Rapid City include SDARNG and agricultural production. A few examples of non-aeronautical land uses include retail development, manufacturing/storage facilities, mineral extraction and even cell phone towers (compatible

with airspace). Non-aeronautical development can be financially lucrative for the airport but must be approved by FAA.

Additional opportunities for non-aeronautical uses are located outside of access to the airfield including land near the initial passenger terminal access road. Considerations for developing property for non-aeronautical uses parcel size, landside roadway access/parking and utilities.

There are no recommendations for non-aeronautical use in this Master Plan, however the airport should continue to explore and market opportunities in areas not needed for aeronautical use. The preferred development alternative in the next chapter and in the subsequent Airport Layout Plan will identify the land needed for aeronautical use.

Summary

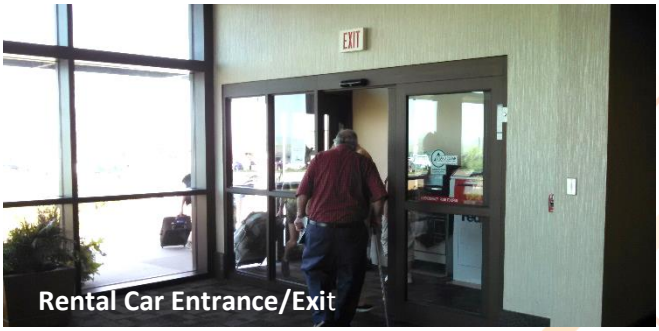
This chapter identifies safety, capacity and development needs for the Rapid City Regional Airport based on forecasted activity levels. These recommendations provide the basis for formulating development alternatives to adequate address recommended improvements. The following summarizes the facility recommendations:

Airside Facilities

- **Maintain Runway 14-32 to accommodate regular use of an Airbus A319, Bombardier Q400 and Boeing B717 aircraft with ARC C-III standards. No runway extension is recommended.**
- **Replace PAPIs on all runways with equipment maintained by the FAA.**
- **Remove hillside near the approach to Runway 14 that penetrates into the protective surfaces and place material in areas to allow for hangar development.**
- **Relocate Long View (Radio Towers) Road to be outside of the expanded RPZ.**
- **Install a MALSR system for Runway 14 to lower the existing RNAV (GPS) minimums.**
- **Upgrade Runway 14 to a Category I ILS approach.**
- **Construct 25-foot wide paved shoulders for TDG-5 taxiways by PAL 1.**
- **Construct 20-foot wide shoulders for TDG-3 and 4 taxiways by PAL 1.**

Passenger Terminal

- **Install an in-line baggage screening system to increase throughput and allow ticket counter space to be used exclusively by airline personnel.**
- **Add an additional security screening lane within the existing space as demand may require within the planning period.**
- **Improve the rental car exit vestibule to allow a wider, more direct corridor for rental car customers.**
- **Provide additional self-service check-in kiosks in the ticketing lobby for added customer convenience.**



Rental Car Entrance/Exit

- Expand concessions in the sterile area as major improvements or expansion of the concourse is made.
- Provide additional parking particularly for rental car storage. It is possible in the short term to use some portions of public parking for rental car storage but this area will not be adequate for the long term.
- Be cognizant of any additional need for the cell phone waiting lot. It is yet to be determined how well this lot is serving passengers' needs particularly as it is unpaved and not well known.

Air Cargo

- Establish an area of apron and associated buildings for air cargo with sufficient airside and landside access. The facility should be sized to meet the requirements in PAL 1 (5,700 SY) with expansion capability through PAL 4 (9,000 SY).
- Locate the cargo apron area so that there is flexibility to either store aircraft in hangars in the area or conveniently tow aircraft for storage in other hangars.

General Aviation

- In PAL 1, construct 57,000 square feet of new T-Hangar space (approximately 45 units) to meet demand and replace 38,060 square feet (27 units) of existing dilapidated hangars.
- Replace smaller water lines in General Aviation area to increase fire flow.


T-Hangar

- Identify development areas for as much as 40% more hangar space with a variety of sizes. T-hangars and large conventional hangars are those that are expected to be in in the greatest demand. Small conventional hangars less than 6,000 square feet are not expected to have as great a demand. Development must include sufficient airside and landside access suitable for the types of hangars.
- Place only large conventional hangars directly on the main apron areas. Any existing small conventional hangars positioned directly on the main aprons should be removed in the long term.
- Relocate the roadway across the general aviation apron area to both allow typical aircraft parking and ensure a safe route for vehicles in the non-movement area.

Landside Facilities

- Coordinate with local transportation planning to prioritize a direct road connection from the airport north to Interstate 90.
- Complete scheduled water system improvements with northwest connection to City water.
- Replace smaller water lines in General Aviation area to increase fire flow.
- Connect the airport to the City of Rapid City's sanitary sewer system.

Support Facilities & Other

- **Identify a new location for the Airport's Snow Removal Equipment buildings and initiate this project in PAL 2. This project is necessary in the short term to free up space for general aviation development.**
- **Identify a location for a general aviation CBP area. The area should include the appropriate access for the airside and landside.**
- **Identify a location for a replacement ATCT in order to update the facility and improve visibility of the movement areas from the tower. Work must be directed by the airport and closely coordinated with the FAA.**
- **Identify a location and layout suitable for the USFS for the fire fighting aircraft which are expected to use the airport in the planning period.**
- **Continue to coordinate with the SDARNG to allow this facility to meet its mission.**

Chapter 5: Alternative Analysis

Introduction

This chapter of the Airport Master Plan discusses airport development alternatives considered in the planning process for the Rapid City Regional Airport (RAP). Alternatives evaluated for this study are based on comparing existing conditions with facility requirements determined from the activity forecast reviewed in detail in the previous chapters. Alternatives found to be reasonable to accommodate the short and long-term needs are identified. Potential impacts of each alternative considered are discussed and used to help the airport select a preferred alternative(s). Alternatives outlined are split into functional facility areas:

- Airfield
- Passenger Terminal
- General Aviation & Other
- Landside
- Support Facilities

A Preferred Development Strategy based on the preferred alternatives is identified at the conclusion of the alternatives analysis. This preliminary plan provides a guideline for implementation based on identified needs and priorities. The plan to implement the preferred alternative is reviewed in more detail in **Chapter 6: Implementation Plan**.

Evaluation Process

The overall guiding principle is to provide an airport facility that adequately serves the community needs and is flexible to industry changes. Alternatives must meet FAA design criteria and be implementable with the existing infrastructure and environment. A wide range of alternatives were evaluated to determine the best solution for the airport to meet anticipated needs identified by Planning Activity Level (PAL), which were described in Chapter 4.

The alternative evaluation process includes identifying, evaluating and finally selecting. Concepts were first prepared based on buildable solutions to meet demand within the developable areas of the airport. Next, these concepts were evaluated by airport management for their ability to realistically meet the demands along with impacts. Criteria used to evaluate alternatives include operational performance, best planning tenets, environmental and fiscal factors. The concepts were narrowed to three Refined Alternatives which were provided to Focus Group members (March 2015) and the Rapid City Regional Airport Board (March 24, 2015). No weighting factors were used for evaluation as they could have skewed the results.

The alternatives were reviewed and refined with feedback from airport management and airport focus groups. All costs for the three refined Alternatives were planning-level estimates in 2015 dollars. Alternatives from one facility area may also have an impact on another facility area so these factors were also considered when compiling one preferred airport development alternative. The Rapid City Regional Airport Board reviewed three refined alternatives at a workshop on March 24, 2015. The preferred alternative was approved by the Rapid City Regional Airport Board on April 14, 2015.

Development Considerations

Each functional area of the airport has specific needs and constraints that affect the formulation of realistic, implementable development alternatives. These are discussed in detail within this Chapter; an overarching consideration at Rapid City is the airport's role in meeting the aviation needs in the region.

Airfield Development Alternatives

The Airfield Development Alternatives reviewed the following infrastructure elements:

- Runway
- Taxiway System
- Airport Traffic Control Tower

Requirements Summary

The airfield is vital to the airport's core infrastructure to accommodate aircraft operations. The following section summarizes key airfield facility requirement findings:

- **The Airbus A319, Bombardier Q400 and Boeing B717 aircraft types (ARC C-III, TDG-4) are expected to remain the critical design aircraft through PAL 4.**
- **No runway extension or configuration modifications to air carrier runway ends are needed to meet length and capacity needs based on forecasted operations.**
- **Enhancements to Runway 14 approach procedures to increase airport operational utility in instrument meteorological conditions should be pursued.**
- **Targeted runway improvements include the Runway 32 blast pad and paved shoulders for Runway 14-32 are needed to meet current design standards.**

Runways

An evaluation of development alternatives to accommodate the airfield facility requirements for each of the Rapid City's runways is described in the following section.

Configuration

Runway 14-32, the 8,701 foot long primary runway, is of sufficient length, width and strength to accommodate regular use of the design aircraft with ARC C-III standards without major restrictions. Runway 5-23, the 3,601 foot long crosswind runway, is identified to serve aircraft with ARC A-I (small) standards and is of sufficient length, width and strength to accommodate this through the planning period. Therefore no alternatives for runway alignment, width, length or strength were evaluated.

Constructing 25-foot wide paved shoulders along the sides of runway 14-32 and upgrading the Runway 32 blast pad for the current runway configuration is a targeted improvement to meet FAA design standards.

Approaches

Recommended improvements include upgrading the Runway 14 approach to a Category I Precision Instrument approach to achieve lower weather minima which increases airport utility. No alternatives were examined for this improvement and the upgrading of the Runway 14 approach to a Category I Precision Instrument approach is included in the preferred alternative.

Land Use

FAA land use standards should be met for all runways. The FAA recently introduced guidance which changed the uses of property within the Runway Protection Zones (RPZ). With the improvement to the approach for Runway 14, the RPZ would increase resulting in a requirement for the airport to remove incompatible uses which for Rapid City is Long View Road. No alternatives were examined for this improvement and the realignment of Long View Road is included in the preferred alternative. See **Exhibit 5-4 Preferred Alternative**.

Table 5-1 –Runway Recommendations

Runway(s)	Improvement
14-32	25’ Paved Runway Shoulder
32	200’ x 200’ Paved Blast Pad
14	Cat I Precision Instrument Approach
14	Realign Long View Road outside of RPZ
14-32 & 5-23	Replace PAPI’s

Source: KLJ Analysis

Taxiway System

An evaluation of development alternatives for the Rapid City taxiway system is described below.

Taxiway A

The airport recently completed a series of projects which realigned all of Taxiway A so that the taxiway is correctly separated from Runway 14-32. As a result of this work, there is no additional work needed to improve Taxiway A and its associated connectors to Runway 14-32.

Taxiway B

Taxiway B is a full parallel taxiway for Runway 5-23. This is sufficient to meet the needs of Runway 5-23 and no additional improvements for this taxiway are recommended in the planning period.

East Parallel Taxiway

The current centerline separation from Taxiway A to Runway 14-32 is 450'. This is sufficient separation to function as a temporary runway expect for two specific constraints. The constraints are as follows:

1. Existing buildings would impede Taxiway A's use as a runway; and
2. The existing gradient does not meet the requirements for a runway.

A runway for Design Group C aircraft require a maximum gradient of ±0.80% for the first and last quarter of the runway and maximum gradient of ±1.00% per 1000'. In two areas that were examined, these requirements exceeded with -0.84% for the first/last quarter of the runway and by 1.04% and -1.23% per 1000' in two other areas.

The constraints of Taxiway A to function as a temporary runway is one reason that a parallel taxiway on the east side of Runway 14-32 was examined. The other reason is the limited space available on the west side of the airport and a recognition that in the long term, development may need to be expanded to the east side. A full parallel taxiway would be necessary for this. Alternatives were developed with and without the full parallel east taxiway as can be identified in **Exhibit 5-1 Alternative 1**, **Exhibit 5-2 Alternative 2** and **Exhibit 5-3 Alternative 3**. An estimate of costs were developed for each alternative and are found in **Table 5-3 Alternative 1 Estimated Costs**, **Table 5-4 Alternative 2 Estimated Costs**, and **Table 5-5 Alternative 3 Estimated Costs**. The preferred alternative was determined to include the east parallel taxiway which was incorporated from Alternative 3. For the Preferred Alternative map and estimated costs see **Exhibit 5-4 Preferred Alternative** and **Table 5-6 Preferred Alternative Estimated Costs**.

Targeted Improvements

Targeted improvements are those that are recommended to meet airport design standards and have limited alternatives.

Correcting Direct Access

Direct access from an apron to a runway should be corrected per FAA airport design standards to reduce the risk of runway incursions. Taxiway B and B1 from the north end of the general aviation apron provide direct access to Runway 14-32 and Runway 5 respectively.

Table 5-2 – Taxiway Recommendations

Taxiway(s)	Improvement
East Parallel	TDG 4 with ability to function as a temporary runway
B	Remove Direct Access to Runway 14-32
B1	Remove Direct Access to Runway 5

Source: KLJ Analysis

Exhibit 5-1 Alternative 1

Table 5-3 –Alternative 1 Estimated Costs

Cost Estimates for Alternative 1 (000's)					
Area	**Description**	**Paving**	**Buildings**	**Other**	**Total**
Main Apron	Apron Paving and Hangars	$ 1,017.0	$ 2,576.0		$ 3,593.0
North Hangar	Hangars and Associated Paving	$ 889.0	$ 2,448.1		$ 3,337.1
Middle Hangar	Hangars and Associated Paving	$ 1,779.0	$ 6,044.2		$ 7,823.2
South Large Hangar	Hangars and Associated Paving	$ 758.3	$ 1,904.0		$ 2,662.3
Terminal	Apron Paving	$ 708.2			$ 708.2
Cargo/CBP	Buildings and Associated Paving	$ 408.0	$ 980.0		$ 1,388.0
Deicing	Paving	$ 1,288.0			$ 1,288.0
USFS	Paving and Associated Fill	$ 3,268.5		$ 1,442.0	$ 4,710.5
ATCT	Building and Associated Paving	$ 63.0	$ 3,450.0		$ 3,513.0
Parking	Paving and Associated Fill	$ 501.6	$ 7,820.0	$ 828.0	$ 9,149.6
SRE Building	Building and Associated Paving	$ 521.3	$ 8,964.5		$ 9,485.8
Roads	New Roads in GA Area and Long View Realignment	$ 1,868.1		$ 1,381.0	$ 3,249.1
	Total	$ 13,184.0	$ 34,472.8	$ 3,651.0	$ 51,307.8

Exhibit 5-2 Alternative 2

Table 5-4 –Alternative 2 Estimated Costs

Cost Estimates for Alternative 2 (000's)					
Area	**Description**	**Paving**	**Buildings**	**Other**	**Total**
Main Apron	Apron Paving and Hangars	$ 1,017.0	$ 3,381.0		$ 4,398.0
North Hangar	Hangars and Associated Paving	$ 889.0	$ 2,448.1		$ 3,337.1
Middle Hangar	Hangars and Associated Paving	$ 1,779.0	$ 6,561.8		$ 8,340.8
South Large Hangar	Hangars and Associated Paving	$ 872.3	$ 2,190.0		$ 3,062.3
Terminal	Apron Paving	$ 708.2			$ 708.2
Cargo/CBP	Buildings and Associated Paving[1]	$ 569.0	$ 1,495.0		$ 2,064.0
Deicing	Paving	$ 1,318.7			$ 1,318.7
USFS	Paving and Associated Fill	$ 3,268.5		$ 1,442.0	$ 4,710.5
ATCT	Building and Associated Paving	$ 63.0	$ 3,450.0		$ 3,513.0
Parking	Paving and Associated Fill	$ 383.9	$ 6,555.0	$ 643.0	$ 7,581.9
SRE Building	Building and Associated Paving	$ 521.3	$ 8,964.5		$ 9,485.8
Roads	New Roads in GA Area and Long View Realignment	$ 1,729.1		$ 1,381.0	$ 3,110.1
	Total	$ 13,119.0	$ 35,045.4	$ 3,446.0	$ 51,630.4

[1] The Cargo area will make use of a portion of the 8,000 square yards of apron being added in this area in 2015.

Exhibit 5-3 Alternative 3

Table 5-5 –Alternative 3 Estimated Costs

Cost Estimates for Alternative 3 (000's)					
Area	**Description**	**Paving**	**Buildings**	**Other**	**Total**
Main Apron	Apron Paving and Hangars	$ 1,017.0	$ 3,381.0		$ 4,398.0
North Hangar	Hangars and Associated Paving	$ 889.0	$ 2,448.1		$ 3,337.1
Middle Hangar	Hangars and Associated Paving	$ 569.0	$ 2,448.1		$ 2,785.8
South Large Hangar	Hangars and Associated Paving	$ 506.0	$ 3,091.0		$ 3,597.0
East Main Apron	Apron Paving, Hangars and Utility Extensions	$ 6,073.3	$ 7,921.0	$ 1,847.7	$ 15,842.0
East Small Hangar	Hangars and Associated Paving	$ 1,104.1	$ 6,640.3		$ 7,744.4
East Taxiway	Paving	$ 21,435.5			$ 21,435.5
Cargo/CBP	Apron Paving, Fill and Buildings	$ 774.7	$ 1,325.0	$ 551.2	$ 2,650.9
Deicing	Paving	$ 3,480.7			$ 3,480.7
USFS	Paving and Associated Fill	$ 3,330.3	$ 460.0	$ 1,520.5	$ 5,310.8
ATCT	Building and Associated Paving	$ 63.0	$ 3,450.0		$ 3,513.0
Roads	New Roads in GA Areas and Long View Realignment	$ 2,231.8		$ 978.0	$ 3,209.8
	Total	$ 41,474.4	$ 30,933.2	$ 4,897.4	$ 77,305.0

Exhibit 5-4 Preferred Alternative

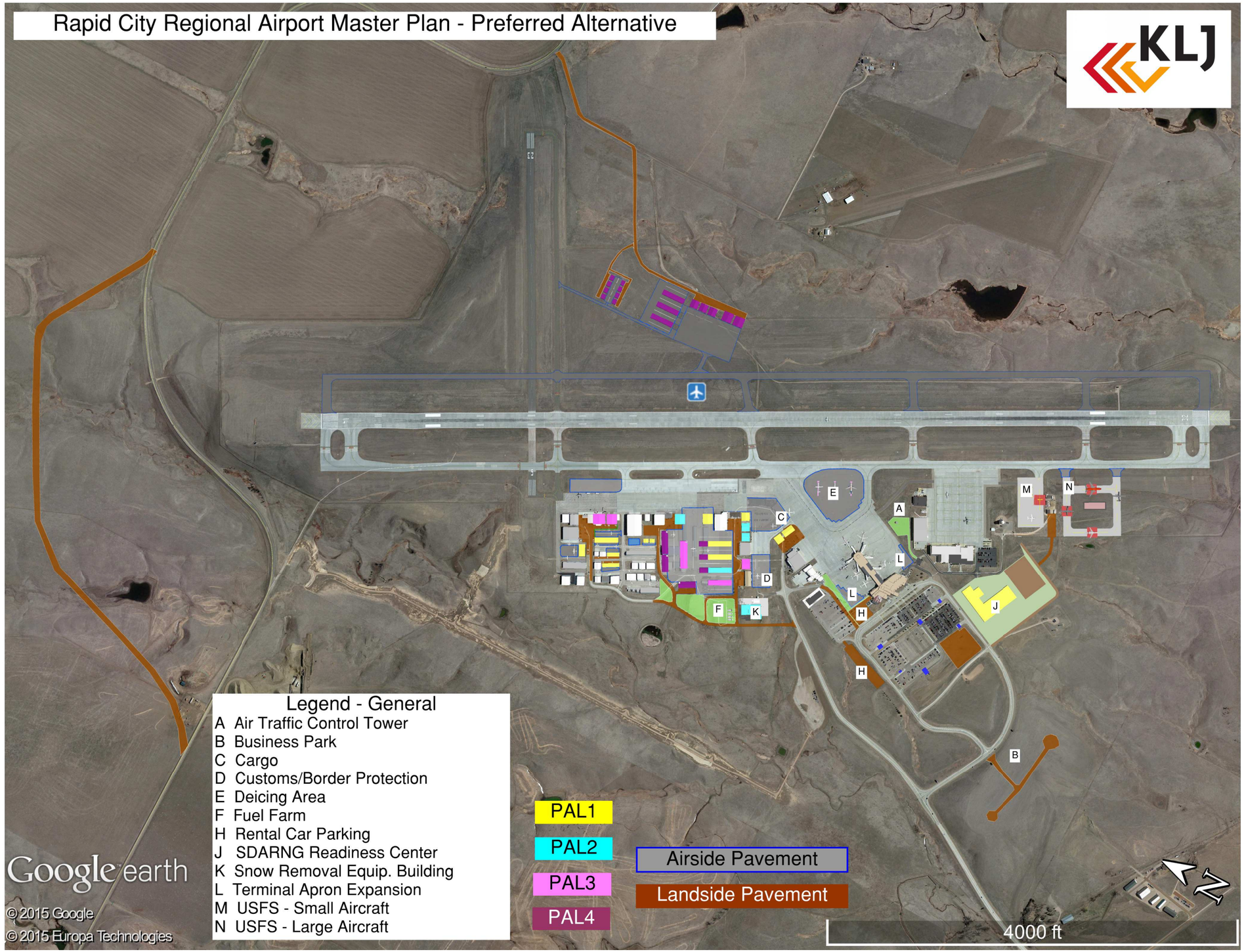


Table 5-6 – Preferred Alternative Estimated Costs

Cost Estimates for Preferred Alternative (000's)					
Area	**Description**	**Paving**	**Buildings**	**Other**	**Total**
Main Apron	Apron Paving and Hangars	$ 1,017.0	$ 3,381.0		$ 4,398.0
North Hangar	Hangars and Associated Paving	$ 889.0	$ 2,448.1		$ 3,337.1
Middle Hangar	Hangars and Associated Paving	$ 1,779.0	$ 6,561.8		$ 8,340.8
South Large Hangar	Hangars and Associated Paving	$ 872.3	$ 2,190.0		$ 3,062.8
East Main Apron	Apron Paving, Hangars and Utility Extensions	$ 3,152.3	$ 3,156.0	$ 1,807.7	$ 8,116.0
East Small Hangar	Hangars and Associated Paving	$ 750.2	$ 3,320.2		$ 4,070.4
East Taxiway	Paving	$ 21,435.5			$ 21,435.5
Terminal	Apron Paving	$ 708.2			$ 708.2
Cargo/CBP	Apron Paving[2], Fill and Buildings	$ 569.0	$ 1,495.0		$ 2,064.0
Deicing	Paving	$ 3,480.7			$ 3,480.7
USFS	Paving and Associated Fill	$ 3,268.5		$ 1,442.0	$ 4,710.5
ATCT	Building and Associated Paving	$ 63.0	$ 3,450.0		$ 3,513.0
Parking	Paving and Associated Fill	$ 868.6	$ 138.0	$ 828.0	$ 1,834.6
SRE Building	Building and Associated Paving	$ 521.3	$ 8,964.5		$ 9,485.8
Roads	New Roads in GA Areas and Long View Realignment	$ 2,730.1		$ 1,841.0	$ 4,571.1
	Total	$ 42,104.7	$ 35,104.6	$ 5,918.7	$ 83,128.0

[2] The Cargo area will make use of a portion of the 8,000 square yards of apron being added in this area in 2015.

Airport Traffic Control Tower

The airport is responsible in cooperation with the FAA for siting, constructing and maintaining an Airport Traffic Control Tower (ATCT) for an airport. The airport, through this master plan study, is evaluating potential sites to identify land so that future ATCT sites remain feasible.

The existing ATCT facility may or may not be maintained at the current site. No significant improvements have been made with the ATCT facility other than maintenance since its original construction in 1964. The current facility has limited line-of-sight to Runway 23, portions of the airline terminal apron and Taxiways T2 and T1. The ATCT is also situated between the SDARNG and USFS installations.

Alternative 0: Existing ATCT Complex

Future development at the current site should be considered. In the future a new ATCT could be developed near the existing ATCT. A taller tower may be able to correct the issues with the current facility. Using the existing area will not provide any room for expansion for either the SDARNG or USFS. Also a temporary tower would need to be constructed in order to ensure air traffic oversight during the construction of the new ATCT.

Alternative 1: North of Airline Terminal within General Aviation Area

A site in this area would be adjacent to the old airline terminal that was removed in 2014. The site is identified on **Exhibit 5-1 Alternative 1**. This site provides a very good view of the entire airport but would use a portion of the General Aviation area which in Alternative 2 is used for Air Cargo.

Alternative 2: Between Airline Terminal and SDARNG

A site in this area would be between the Airline Terminal and the SDARNG facility. The site is identified on **Exhibit 5-2 Alternative 2**. Landside access would be a narrow drive from an existing employee parking area. There have been no identified uses for this area as it is a triangular remnant that is otherwise unusable but with very good airfield visibility.

Alternative 3: Remote East Site

With the development on the east side of the airfield a location for an ATCT was identified here. The site is identified on **Exhibit 5-3 Alternative 3**. The site would have very good visibility. As with all other development on the east side, all utilities will need to be extended to allow for the ATCT facility.

Preferred Alternative

The preferred alternative is Alternative 2. This alternatives best utilizes available space and meets facility requirements. It is depicted in **Exhibit 5-4 Preferred Alternative**.

Table 5-7 – Airport Traffic Control Tower Alternative Summary

Alternative	Actions	Strengths	Weaknesses
0	New ATCT in Existing Area	• Can more easily connect to existing infrastructure	• Site within constrained area between SDARNG and USFS areas • Requires higher tower to clear most line of sight issues
1	New ATCT North of Airline Terminal in GA Area	• Central location • Clear line of sight • Adequate space	• Site within constrained general aviation area • Impedes growth of Air Cargo
2	New ATCT between Airline Terminal and SDARNG	• Clear line of sight • Adequate space • Uses otherwise unusable area	• Narrow landside access
3	New ATCT on the East Side	• Central Location • Clear line of sight • Adequate space	• No existing public access • No existing utilities

Source: KLJ Analysis

Passenger Terminal Alternatives

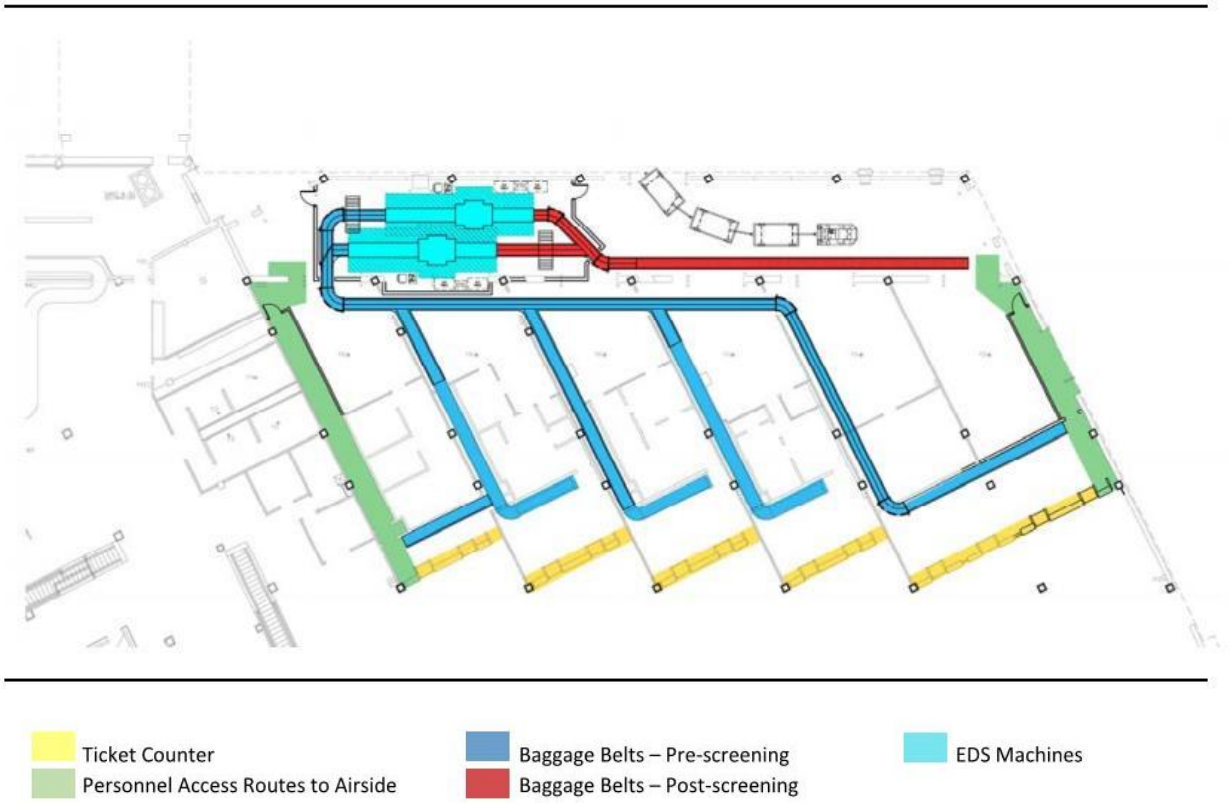
The Passenger Terminal was recently renovated which addressed space for passenger screening, concessions, baggage claim, rental cars and updating the facility. Chapter 4 – Requirements identified only a few items which should be addressed in the planning period. The most notable item is baggage screening and baggage makeup.

Baggage Screening is currently conducted behind each airline counter and is not sufficiently sized or configured to industry standards. The deficiency is noticed the most during heavy traffic loads. The Baggage Makeup area is directly related to Baggage Screening and therefore the two areas were examined together. The 2008 Airport Master Plan (AMP) generated four alternatives and a new alternative was added as a result of this Master Plan. This new alternative was not created in the 2008 AMP because of the plans at the time to continue to ground load some airlines from the concourse in the general area of Gates 1 and 2. This is no longer the case and therefore the new alternative, 2015-1 Alternative, baggage screening/baggage makeup alternative was created.

2008 AMP Alternative 1

Alternative 2008-1 proposes standard height baggage conveyors from behind each ticket counter to a pair of baggage screening machines behind the 2 airline positions closest to the center of the terminal. The baggage makeup area would be in the remaining portion of the existing baggage truck/cart corridor behind the remaining airline positions. All improvements would be inside the existing baggage truck/cart corridor with no building expansion. There would be two access points for airline personnel to enter the airside of the terminal.

Exhibit 5-5 –Baggage Screening/Makeup Alternative 2008-1

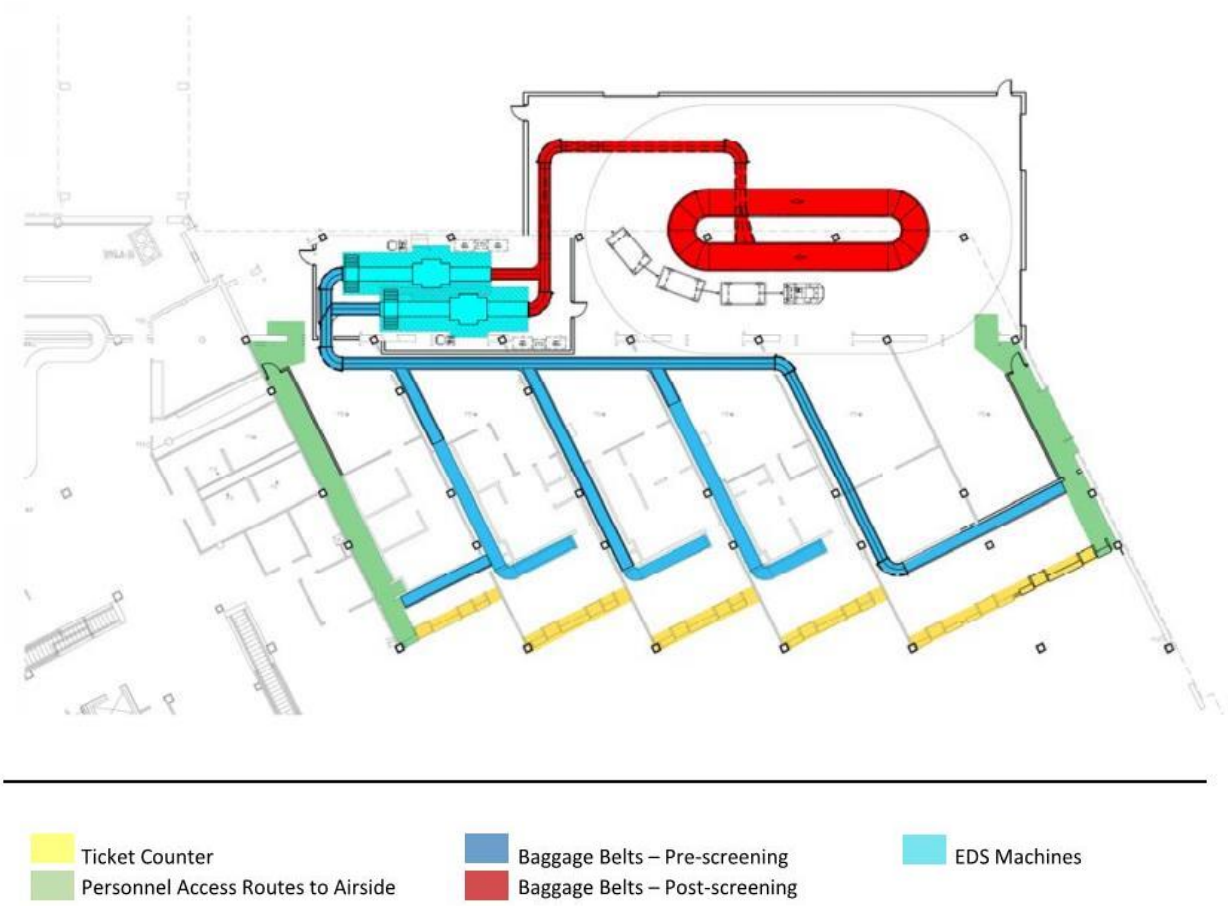


Source: Rapid City Regional Airport Master Plan 2008

2008 AMP Alternative 2

Alternative 2008-2 proposes standard height baggage conveyors from behind each ticket counter to a pair of baggage screening machines behind the 2 airline positions closest to the center of the terminal. The baggage makeup area would expand out and remain behind other airline positions. The baggage makeup area would have an oval conveyor for baggage truck/cart access. There would be two access points for airline personnel to enter the airside of the terminal.

Exhibit 5-6 – Baggage Screening/Makeup Alternative 2008-2

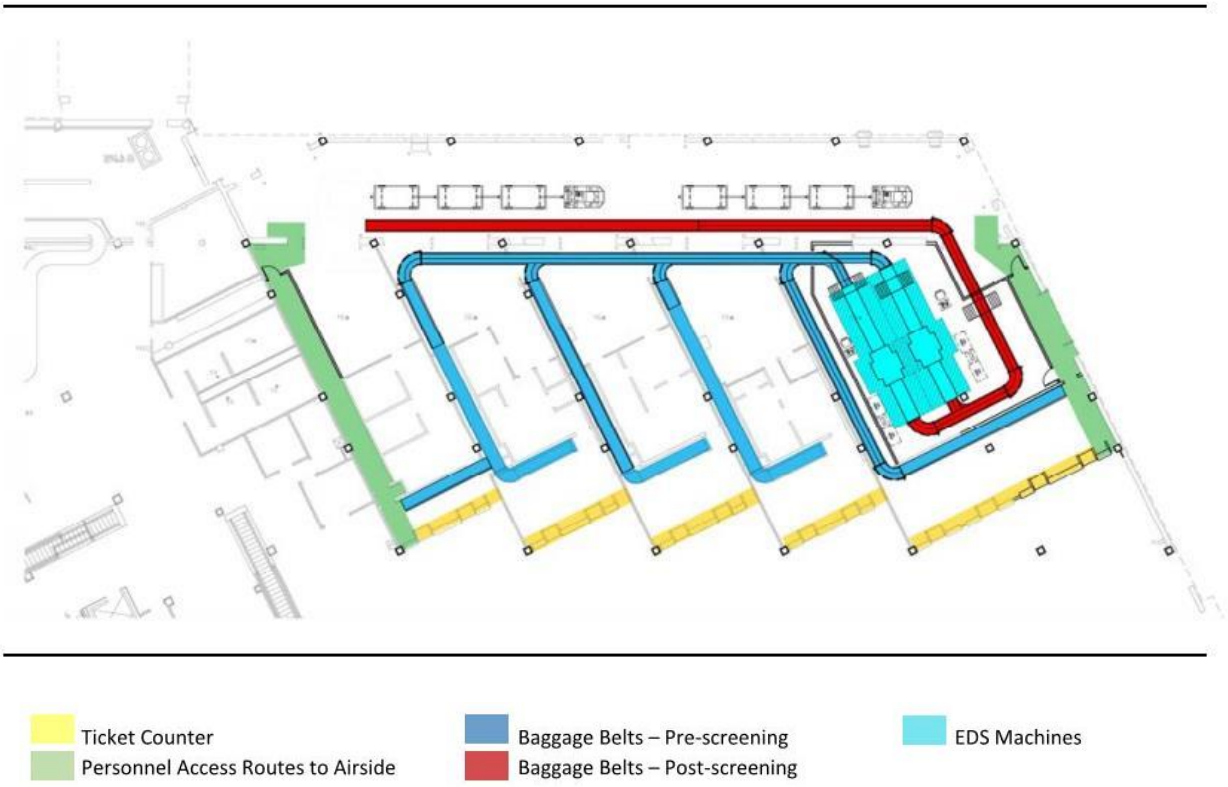


Source: Rapid City Regional Airport Master Plan 2008

2008 AMP Alternative 3

Alternative 2008-3 proposes standard height baggage conveyors from behind each ticket counter to a pair of baggage screening machines behind the 2 airline positions furthest from the center of the terminal. The baggage makeup area would use the existing baggage truck/cart corridor behind the remaining airline positions. All improvements would be inside the existing baggage truck/cart corridor and last 2 airline positions with no building expansion. There would be two access points for airline personnel to enter the airside of the terminal.

Exhibit 5-7 – Baggage Screening/Makeup Alternative 2008-3

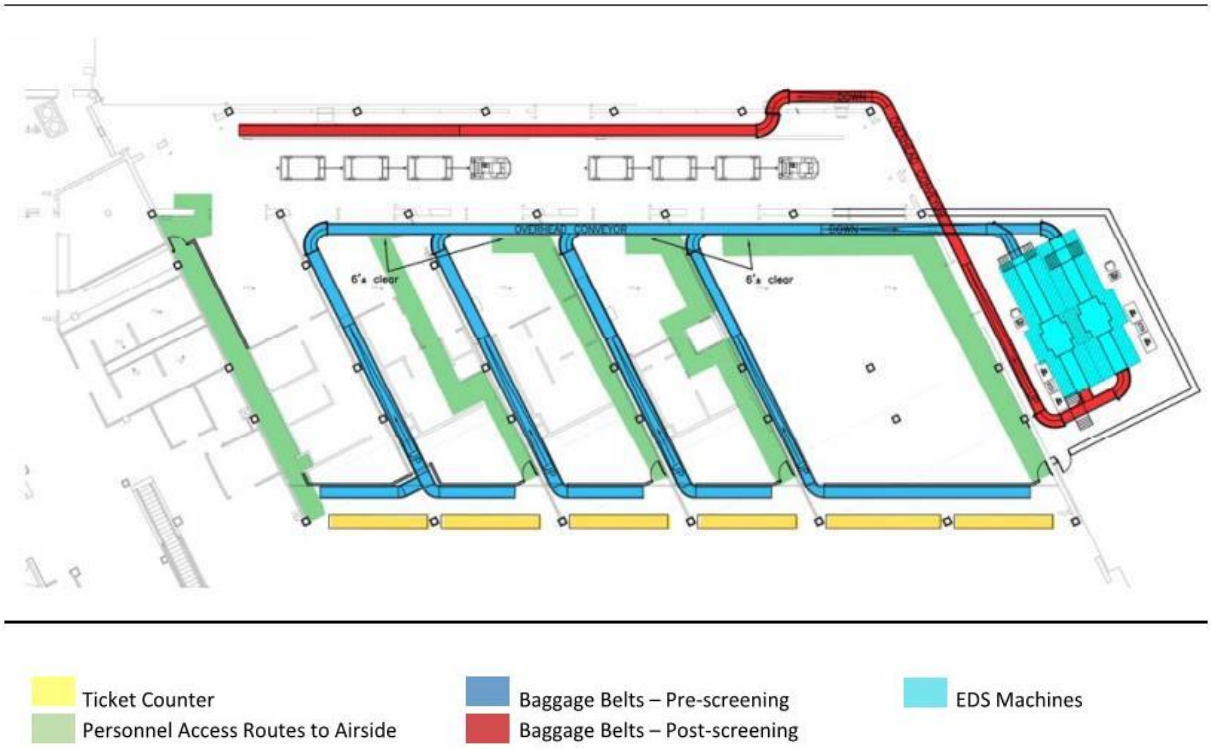


Source: Rapid City Regional Airport Master Plan 2008

2008 AMP Alternative 4

Alternative 2008-4 proposes standard height baggage conveyors from behind each ticket counter then elevated overhead to a pair of baggage screening machines outside of the existing terminal. The baggage makeup area would use the existing baggage truck/cart corridor behind the remaining airline positions. There would be an access point with 6 foot head room from each airline position to the airside of the terminal. This alternative was the preferred concept in the 2008 AMP.

Exhibit 5-8 – Baggage Screening/Makeup Alternative 2008-4



Source: Rapid City Regional Airport Master Plan 2008

2015 AMP Alternative 1

Alternative 2015-1 proposes standard height baggage conveyors from behind each ticket counter then elevated overhead through the current baggage truck/cart corridor then outside parallel to the concourse until it drops down to a pair of baggage screening machines underneath the terminal concourse. The baggage makeup area would be between the baggage screening area and the main terminal area. There would be an access point with 6 foot head room from each airline position to the airside of the terminal.

Exhibit 5-9 – Baggage Screening/Makeup Alternative 2015-1

Table 5-8 – Baggage Screening/Makeup Expansion Summary

Alt	Actions	Strengths	Weaknesses
No Build	No Build	• Minimal cost	• Does not meet current baggage screening demands • High staffing costs for TSA
2008-1	• Standard level conveyors • Screening behind airline positions closest to center of terminal • Makeup within the existing baggage truck/cart corridor	• No building expansion needed • Installs 2 baggage screening devices • Leaves room for terminal to be expanded with additional airline positions	• Tight space for baggage screening • Tight space for baggage makeup • Baggage makeup is linear requiring airlines to collect all bags on first run through • Only 2 access points for airlines to enter airside
2008-2	• Standard level conveyors • Screening behind airline positions closest to center of terminal • Makeup with an oval structure including the existing baggage truck/cart corridor	• Sufficient space for makeup with oval conveyor to collect bags • Installs 2 baggage screening devices • Leaves room for terminal to be expanded with additional airline positions	• Requires building expansion and affects one aircraft gate • Tight space for baggage screening • Only 2 access points for airlines to enter airside
2008-3	• Standard level conveyors • Screening behind airline positions furthest from center of terminal • Makeup within existing baggage truck/cart corridor	• No building expansion needed • Installs 2 baggage screening devices • Baggage makeup area is as existing	• Baggage makeup is linear requiring airlines to collect all bags on first run through • Only 2 access points for airlines to enter airside • Limits airline positions to 4 with no room for expansion
2008-4	• Standard level and overhead conveyors • Screening in new building area furthest from center of terminal • Makeup within existing baggage truck/cart corridor	• Installs 2 baggage screening devices • Baggage makeup area is as existing	• Baggage makeup is linear requiring airlines to collect all bags on first run through • Only 2 access points for airlines to enter airside • Limits airline positions to 6 with no room for expansion
2015-1	• Standard level and overhead conveyors • Screening under terminal concourse • Makeup under terminal concourse	• Installs 2 baggage screening devices • Baggage Screening area is sufficient • Sufficient space for makeup with oval conveyor to collect bags • Leaves room for terminal to be expanded with additional airline positions • Screening would be immediately below existing TSA passenger screening	• Requires building expansion • Largest amount of expanded space and largest amount of conveyor system

Source: KLJ Analysis

Recommended Baggage Screening/Baggage Makeup

The alternatives summarized in the above table are provided in a general sense as this master plan did not complete a terminal specific analysis. That being said, the need for an inline baggage screening system and consolidated make up area is expected to be a near term issue for the airport. It is recommended that the airport prioritize this need and consider Alternative 2015-1 as the best of these five presented alternatives. Additional evaluation is recommended before proceeding with a project for the baggage screening and makeup areas.

Terminal Apron

Considerations

The terminal apron needs to be sized to accommodate the maneuvering of the design aircraft for each concourse gate. Facility requirements identified the need for at least two de-icing pads and to continue to use the terminal for Remain-Over-Night (RON) parking stands.

Terminal Apron Alternative 0 (no change)

If no changes are made the current deicing facility which is adjacent and parallel to taxilane T1 would continue to be used. The deicing pad is sufficient for one Group III aircraft. With the removal of the old terminal building the space is opened up enough to use this area for other purposes.

Terminal Apron Alternative 1

Alternative 1 established three Group III aircraft deicing positions which would all be parallel to Taxilane T1 and use a portion of Taxilane T1. This option requires 9,300 square yards of new paving.

On the Terminal apron 2,600 and 1,500 square yards of concrete would be added to square off these aprons on the north and south side of the terminal. This would allow more room for aircraft push back. The entry road to the car rental area would be realigned 300’ to the northwest and the amount of parking for car rentals would stay relatively equal in the existing area. See **Exhibit 5-1 Alternative 1.**

Terminal Apron Alternative 2

Alternative 2 established three Group III aircraft deicing positions which were perpendicular to Taxiway A and also use a portion of Taxilane T1. This option requires 8,300 square yards of new paving.

On the terminal apron 2,600 and 1,500 square yards of concrete would be added to square off these aprons on the north and south side of the terminal. This would allow more room for aircraft push back. The entry road to the car rental area would be realigned 300’ to the northwest and the amount of parking for car rentals would stay relatively equal in the existing area. See **Exhibit 5-2 Alternative 2.**

Terminal Apron Alternative 3

Alternative 3 established three Group III aircraft deicing positions which were perpendicular to Taxiway A but did not used Taxilane T1 or T2. This option requires 25,200 square yards of new paving.

No other changes would be made to the terminal apron. See **Exhibit 5-3 Alternative 3.**

Table 5-9 – De-Icing Apron Alternative Evaluation

Alts	Actions*	Strengths	Weaknesses
No Change	No Action	• Minimal investment	• Only one position • Could impede air cargo depending on preferred cargo area alternative • Future capacity needs not met
1	• Construct 9,300 SY adjacent to T1 • Pavement markings for 3 - Group III aircraft positions	• One position available without impacting T1	• Requires use of T1 when all 3 positions are active
2	• Construct 8,300 SY adjacent to T1 • Pavement markings for 3 - Group III aircraft positions	• Lease amount of paving	• Requires use of T1 when all 3 positions are active • Requires T1 to be realigned to make one unimpeded position
3	• Construct 25,200 SY between T1 and T2 • Pavement markings for 3 - Group III aircraft positions	• Provides greatest amount of space without impacting Taxilanes T1 or T2	• Largest amount of paving required

Source: KLJ Analysis.

Preferred Alternative

The preferred alternative is Alternative 3. This alternative best utilizes available space and meets facility requirements. The concept provides a de-ice facility without impacting either T1 or T2. Any containment needs for the deicing area will need to be evaluated at the time of design. The paving could be accomplished in phasing adding 1 to 2 positions initially.

The terminal apron would be expanded by squaring off the corners of the apron as identified in Alternatives 1 and 2. See Exhibit 5-4 Preferred Alternative.

General Aviation & Other Development Alternatives

General Aviation

Rapid City is forecast to see growth in general aviation (GA) operations and based aircraft. The airport is the only public use facility serving Rapid City and therefore should be sufficient to meet the general aviation needs of the area as well as the commercial needs already identified. General Aviation has seen growth in the Rapid City area but development of facilities has been only on an incremental basis.

The following section summarizes key general aviation facility requirement findings:

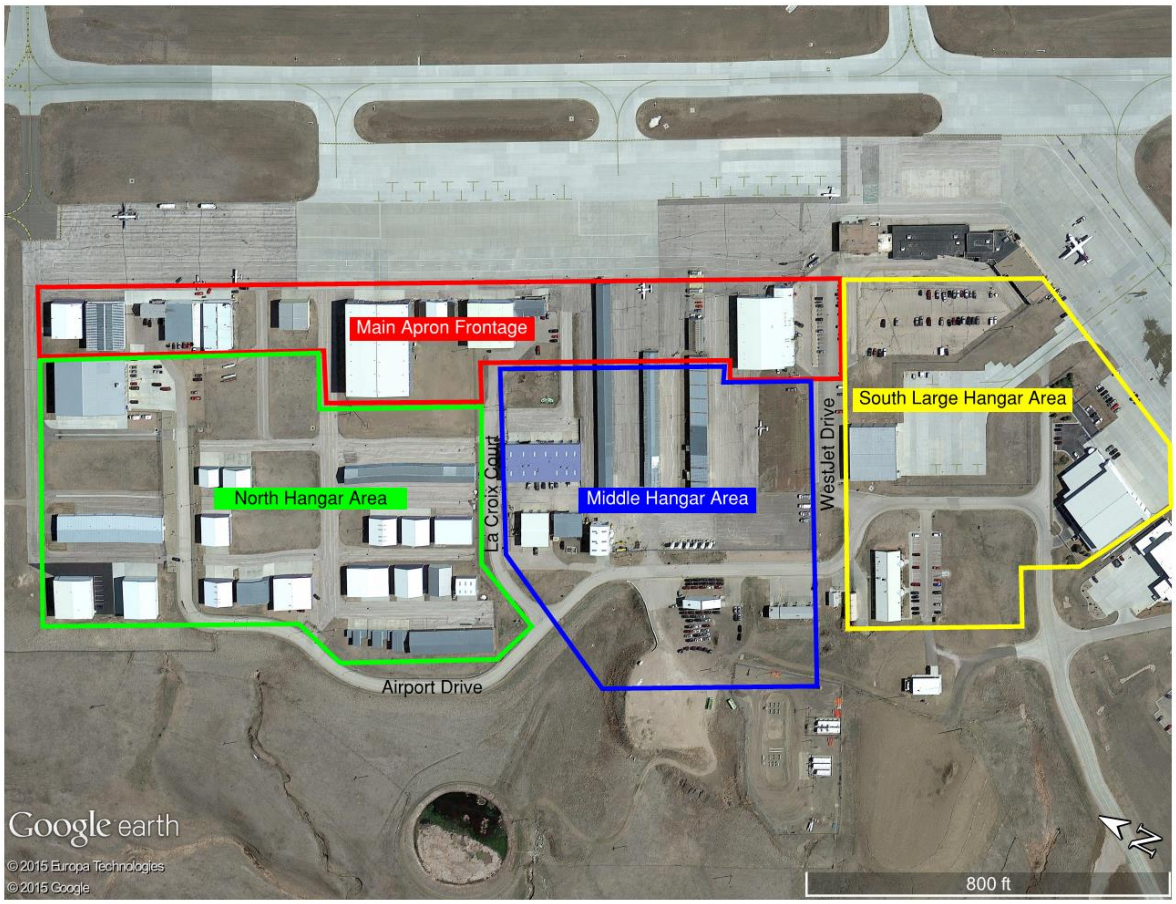
- **Provide an additional 40 percent of aircraft storage space to forecast demand.**
- **Replace capacity scheduled to be lost when 27 T-hangar units (38,060 square feet) are demolished.**
- **Provide flexible development plans to accommodate growth for different sizes of aircraft and types of users.**

GA activity at Rapid City is located on the west side of Runway 14-32 between the Airline Terminal and the approach to Runway 5. This area is constrained and will require fill and proper reuse of land to accommodate development needs.

GA development concepts were primarily on the west side but alternatives using the east side were also examined. The Airport required an immediate layout concept for small hangars during the master plan process and this development concept for the 'north hangar area' was used in all 3 alternatives. There are two primary groups of general aviation aircraft that the hangar development is intended to address. These are Group I Aircraft (<49' wingspan, with a 79' Taxilane Object Free Area TOFA) and Group II Aircraft (≥49' but <79' wingspan, with a 115' TOFA). To simplify how the alternatives are examined the general aviation area is divided into four areas which are shown on the following **Exhibit 5-10 General Aviation Areas**:

Main Apron Frontage (RED) – all hangars with frontage to the main apron excluding any hangars in the south large hangar area.
North Hangar Area (GREEN) - all hangars north of La Croix Court excluding any hangars fronting the main apron.
Middle Hangar Area (BLUE) – all hangars between WestJet Drive and La Croix Court excluding any hangars fronting on the main apron.
South Large Hangar Area (YELLOW) – all hangars south of WestJet Drive and north of the Airline Terminal including hangars fronting the main apron.

Exhibit 5-10 – General Aviation Areas



Source: Google Earth and KLJ Analysis

North Hangar Area

As noted before, this area of hangar development is identical for each of the three alternatives. This arrangement was determined by the airport to facilitate short term development. This north hangar area is the area north of La Croix Court, and is shown in the following **Exhibit 5-11 North Hangar Area**.

The layout for the north hangar area will add the most amount of hangar space in this area for primarily Group I aircraft which currently are in this area. The following are the hangars:

10 Unit T-Hangar in PAL1
4 Unit Group I Hangar in PAL1
3 Unit Group I Hangar in PAL1
40'x50' Hangars (2 in PAL1)
80'x120' Hangar in PAL1

Exhibit 5-11 North Hangar Area

Source: Google Earth and KLJ Analysis

General Aviation Alternative 1

The general aviation layout for Alternative 1 is described below and found in **Exhibit 5-12 Alternative 1 GA.**

Main Apron Frontage

Add 7,000[3] square yards of apron to the north end of the apron to maintain consistent 320' depth of the apron from hangars. Hangars include:

100'x100' Hangar in PAL1
100'x100' Hangar in PAL3 after removal of existing 60'x60' hangar
120'x100' Hangar in PAL3 after removal of 2 smaller hangars (existing hangars have a total of 11,100 square feet of space)

Middle Hangar Area

A group II taxilane will be included to access the main apron area. Hangars include:

10 Unit T-Hangars (2 in PAL1, 1 in PAL2, 1 in PAL3)
4 Unit Group I Hangar in PAL3
6 Unit Group II T-Hangars (1 in PAL3, 1 in PAL4)
60'x70' Hangars (2 in PAL4)

South Large Hangar Area

A group II taxilane will remain to access the main apron. Hangar development would only be on the north side to allow storage of aircraft in front of hangars without impeding access to other hangars for Group II aircraft. The apron would be expanded by 6,300 square yards to the west adjacent to the existing TSA office building. Hangars include:

80'x80' Hangars (1 in PAL1, 2 in PAL2)
100'x80' Hangar in PAL3

Table 5-10 Hangars for Alternative 1

Hangars for Alternative 1					
Aircraft Group	**Description**	**Units**	**Square Feet**	**Need by PAL4**	**Excess/ (Deficiency) of hangar space**
Group I	T-Hangars	80	111,830	113,970	(2,140)
Group I & II	Small Conventional	33	120,263	86,280	33,983
Group II	Large Conventional	14	175,175	164,790	10,385
		Total	407,268	365,040	42,228

[3] The Runway Visibility Zone would restrict some of this apron unless the threshold to Runway 5 were relocated to the east by at least 105 feet. Any relocation of the Runway 5 threshold must consider the close proximity of Taxiway A and Runway 14-32 as well as issue of removing any direct taxiway connections from the apron to Runway 5 and 14-32.

Exhibit 5-12 Alternative 1 - GA

General Aviation Alternative 2

The general aviation layout for Alternative 2 is described below and found in **Exhibit 5-13 Alternative 2 - GA.**

Main Apron Frontage

Add 7,000[4] square yards of apron to the north end of apron to maintain consistent 320' depth of the apron from the hangars. Hangars include:

100'x100' Hangar in PAL1
100'x100' Hangar in PAL2
100'x100' Hangar in PAL3 after removal of existing 60'x60' hangar
120'x100' Hangar in PAL3 after removal of 2 smaller hangars (existing hangars have a total of 11,100 square feet of space)

Middle Hangar Area

Group II taxilane for access to main apron. Hangars include:

10 Unit T-Hangars (2 in PAL1, 1 in PAL2, 1 in PAL3)
4 Unit T-Hangars (3 in PAL4)
8 Unit Group II T-Hangar in PAL3
4 Unit Group II Hangar in PAL4
3 Unit Group II Hangars (2 in PAL4)

South Large Hangar Area

A group II taxilane will remain to access the main apron. Hangar development would only be on the north side to allow storage of aircraft in front of hangars without impeding access to other hangars for Group II aircraft. The apron would be expanded by 6,300 square yards to the west adjacent to the existing TSA office building. Hangars include:

80'x80' Hangars (1 in PAL1, 2 in PAL2)
100'x80' Hangar in PAL3

Table 5-11 Hangars for Alternative 2

Hangars for Alternative 2					
Aircraft Group	**Description**	**Units**	**Square Feet**	**Need by PAL4**	**Excess/ (Deficiency) of hangar space**
Group I	T-Hangars	89	117,322	113,970	3,352
Group I & II	Small Conventional	37	127,143	86,280	40,863
Group II	Large Conventional	15	185,175	164,790	20,385
		Totals	429,640	365,040	64,600

[4] The Runway Visibility Zone would restrict some of this apron unless the threshold to Runway 5 were relocated to the east by at least 105 feet. Any relocation of the Runway 5 threshold must consider the close proximity of Taxiway A and Runway 14-32 as well as issue of removing any direct taxiway connections from the apron to Runway 5 and 14-32.

Exhibit 5-13 Alternative 2 - GA

General Aviation Alternative 3

The general aviation layout for Alternative 3 is described below and found in **Exhibit 5-14 Alternative 3 – GA West** and **Exhibit 5-15 Alternative 3 GA East.**

Main Apron Area

Add 7,000[5] square yards of apron to the north end of apron to maintain consistent 320' depth of the apron from hangars. Hangars include:

100'x100' Hangar in PAL1
100'x100' Hangar in PAL2
100'x100' Hangar in PAL3 after removal of existing 60'x60' hangar
120'x100' Hangar in PAL3 after removal of 2 smaller hangars (existing hangars have a total of 11,100 square feet of space)

Middle Hangar Area

Group I taxilane for access to main apron. Hangars include:

10 Unit T-Hangars (2 in PAL1)
4 Unit T-Hangars (2 in PAL2)

South Large Hangar Area

The apron will be suited to group II aircraft but no designated taxilane would exist as hangars are constructed on the north and south side of the apron. This will not allow aircraft to be parked in front of the hangars without impeding access to other hangars for Group II aircraft. Hangars include:

80'x80' Hangars (2 in PAL1, 2 in PAL2, 2 in PAL3)

East General Aviation Area

45,800 square yards of main apron area on the east side of the airport. Hangars include:

100'x100' Hangars (2 in PAL2, 1 in PAL3, 1 in PAL4)
80'x80' Hangars (2 in PAL2, 1 in PAL3, 1 in PAL4)
10 Unit T-Hangars (2 in PAL2, 1 in PAL3, 3 in PAL4)
40'x50' Hangars (8 in PAL3, 8 in PAL4)

Table 5-12 Hangars for Alternative 3

Hangars for Alternative 3					
Aircraft Group	**Description**	**Units**	**Square Feet**	**Need by PAL4**	**Excess/ (Deficiency) of hangar space**
Group I	T-Hangars	128	162,100	113,970	48,130
Group I & II	Small Conventional	35	104,983	86,280	18,703
Group II	Large Conventional	25	219,975	164,790	55,185
		Totals	529,058	365,040	164,018

[5] The Runway Visibility Zone would restrict some of this apron unless the threshold to Runway 5 were relocated to the east by at least 105 feet. Any relocation of the Runway 5 threshold must consider the close proximity of Taxiway A and Runway 14-32 as well as issue of removing any direct taxiway connections from the apron to Runway 5 and 14-32.

Exhibit 5-14 Alternative 3 - GA West

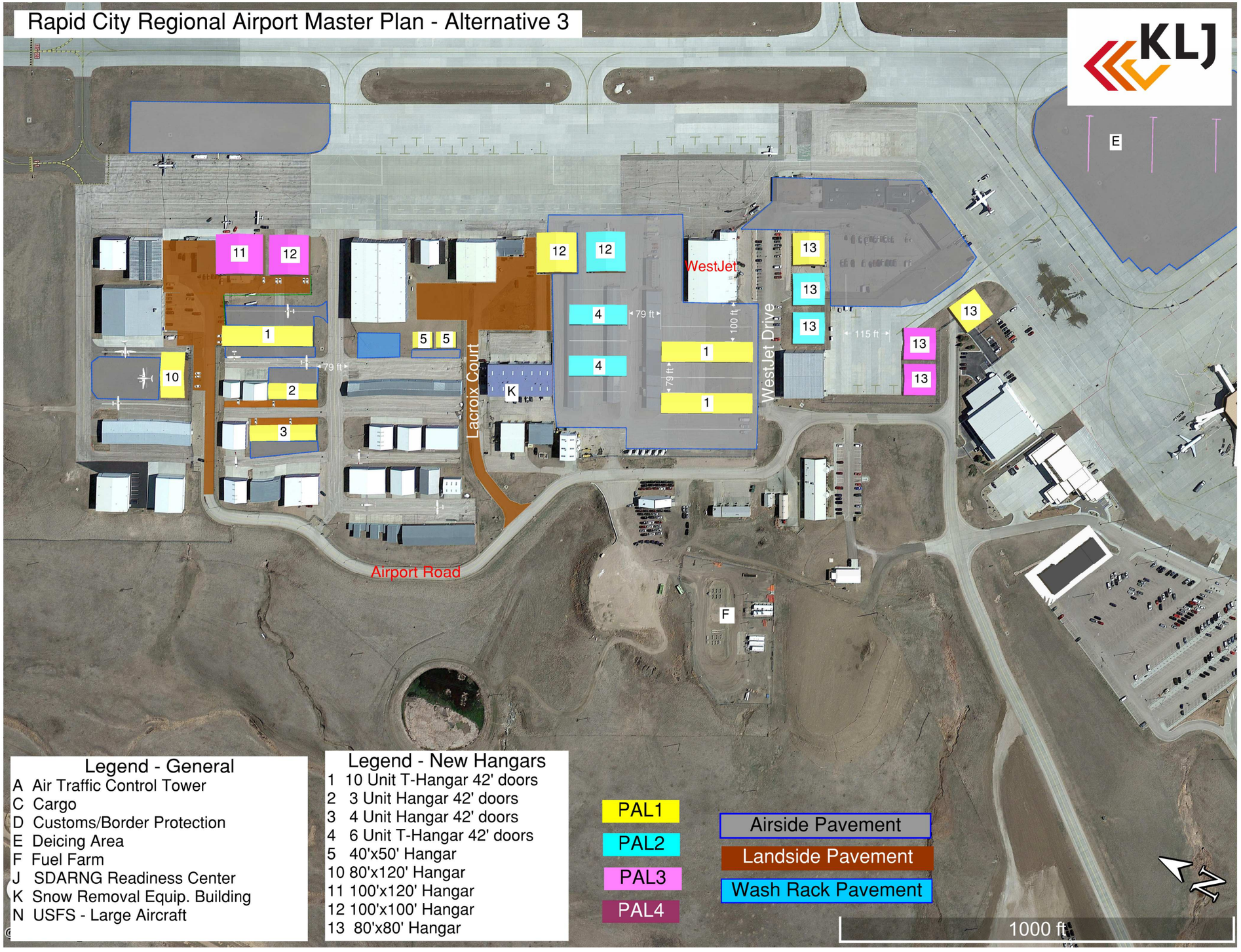
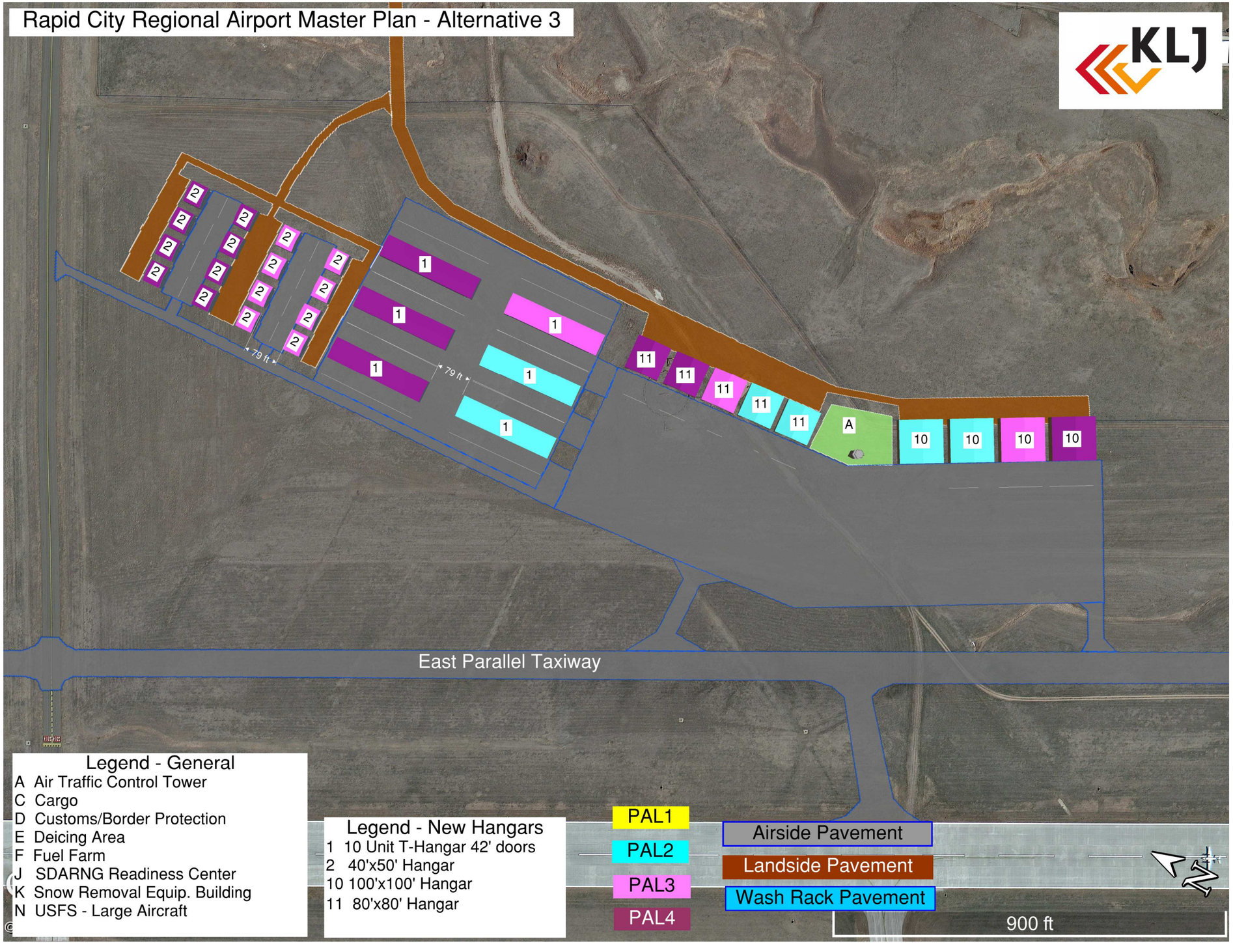


Exhibit 5-15 Alternative 3 - GA East



Preferred Alternative

The preferred alternative for General Aviation is Alternative 2 and a portion of hangar development on the east side from Alternative 3. This makes the best use of space, has the ability to accommodate general aviation and air cargo in an integrated manner and provides the opportunity for growth to the east in the long term. See Exhibit 5-16 Preferred Alternative GA – West and Exhibit 5-17 Preferred Alternative GA - East.

Main Apron Frontage

Add 7,000[6] square yards of apron to the north end of apron to maintain consistent 320' depth of the apron from the hangars. Hangars include:

- 100'x100' Hangar in PAL1
- 100'x100' Hangar in PAL2
- 100'x100' Hangar in PAL3 after removal of existing 60'x60' hangar
- 120'x100' Hangar in PAL3 after removal of 2 smaller hangars (existing hangars have a total of 11,100 square feet of space)

Middle Hangar Area

Group II taxilane for access to main apron. Hangars include:

- 10 Unit T-Hangars (2 in PAL1, 1 in PAL2, 1 in PAL3)
- 4 Unit T-Hangars (3 in PAL4)
- 8 Unit Group II T-Hangar in PAL3
- 4 Unit Group II Hangar in PAL4
- 3 Unit Group II Hangars (2 in PAL4)

South Large Hangar Area

A group II taxilane will remain to access the main apron. Hangar development would only be on the north side to allow storage of aircraft in front of hangars without impeding access to other hangars for Group II aircraft. The apron would be expanded by 6,300 square yards to the west adjacent to the existing TSA office building. Hangars include:

- 80'x80' Hangars (1 in PAL1, 2 in PAL2)
- 100'x80' Hangar in PAL3

East General Aviation Area

45,800 square yards of main apron area on the east side of the airport. Hangars include:

- 100'x100' Hangars (2 in PAL4)
- 80'x80' Hangars (3 in PAL4)
- 10 Unit T-Hangars (2 in PAL2, 1 in PAL3, 3 in PAL4)
- 40'x50' Hangars (8 in PAL3, 8 in PAL4)

[6] The Runway Visibility Zone would restrict some of this apron unless the threshold to Runway 5 were relocated to the east by at least 105 feet. Any relocation of the Runway 5 threshold must consider the close proximity of Taxiway A and Runway 14-32 as well as issue of removing any direct taxiway connections from the apron to Runway 5 and 14-32.

Table 5-13 Hangars for Preferred Alternative

Hangars for Preferred Alternative							
Aircraft Group	Description	Units		Square Feet		Need by PAL4	Excess/ (Deficiency) of hangar space
		W	E	W	E		
Grp I	T-Hangars	89	30	117,322	35,190	113,970	38,542
Grp I & II	Small Conventional	37	8	127,143	16,000	86,280	56,863
Grp II	Large Conventional	15	5	185,175	39,200	164,790	59,585
			Totals	429,640	90,390	365,040	154,990

Exhibit 5-16 Preferred Alternative - GA West

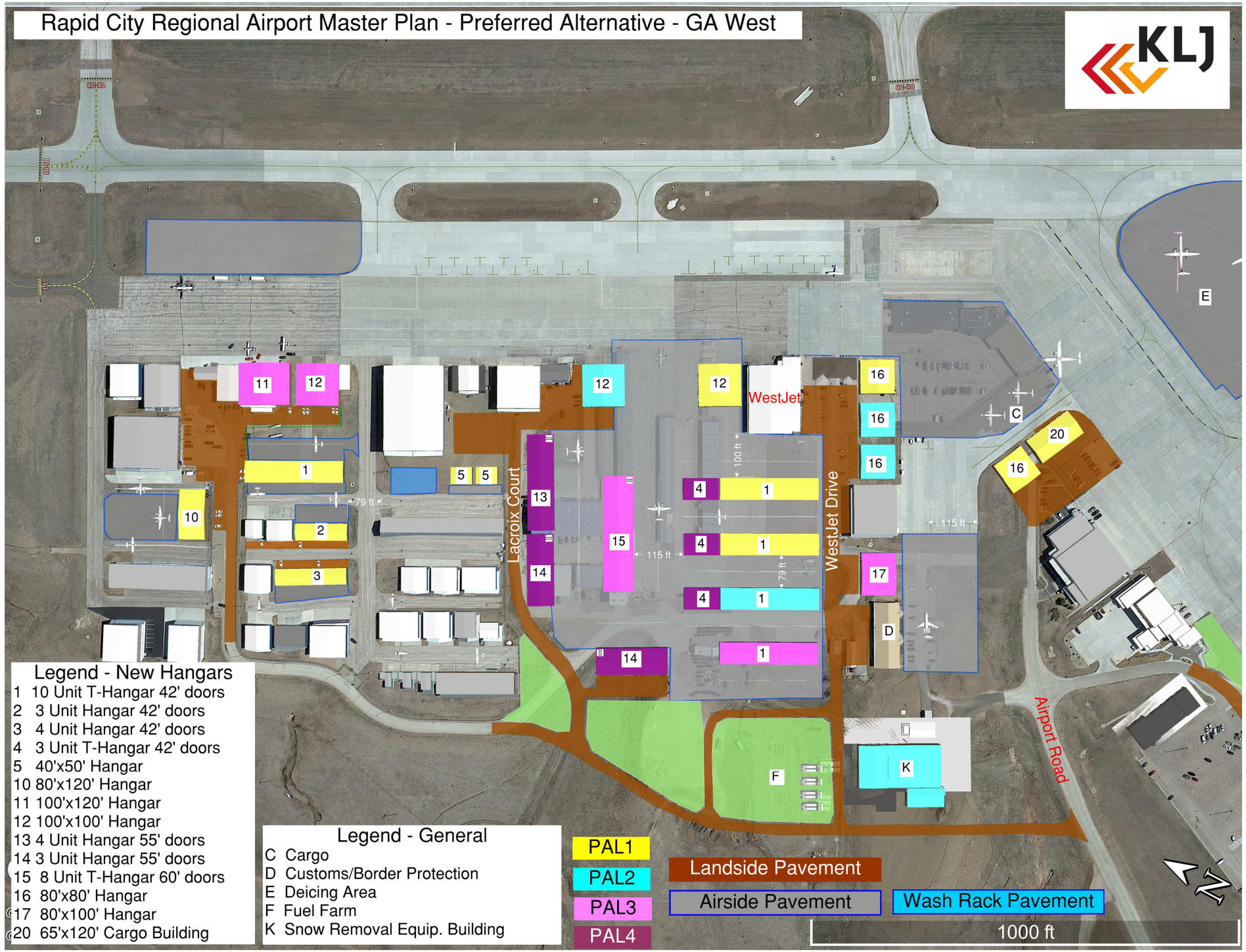
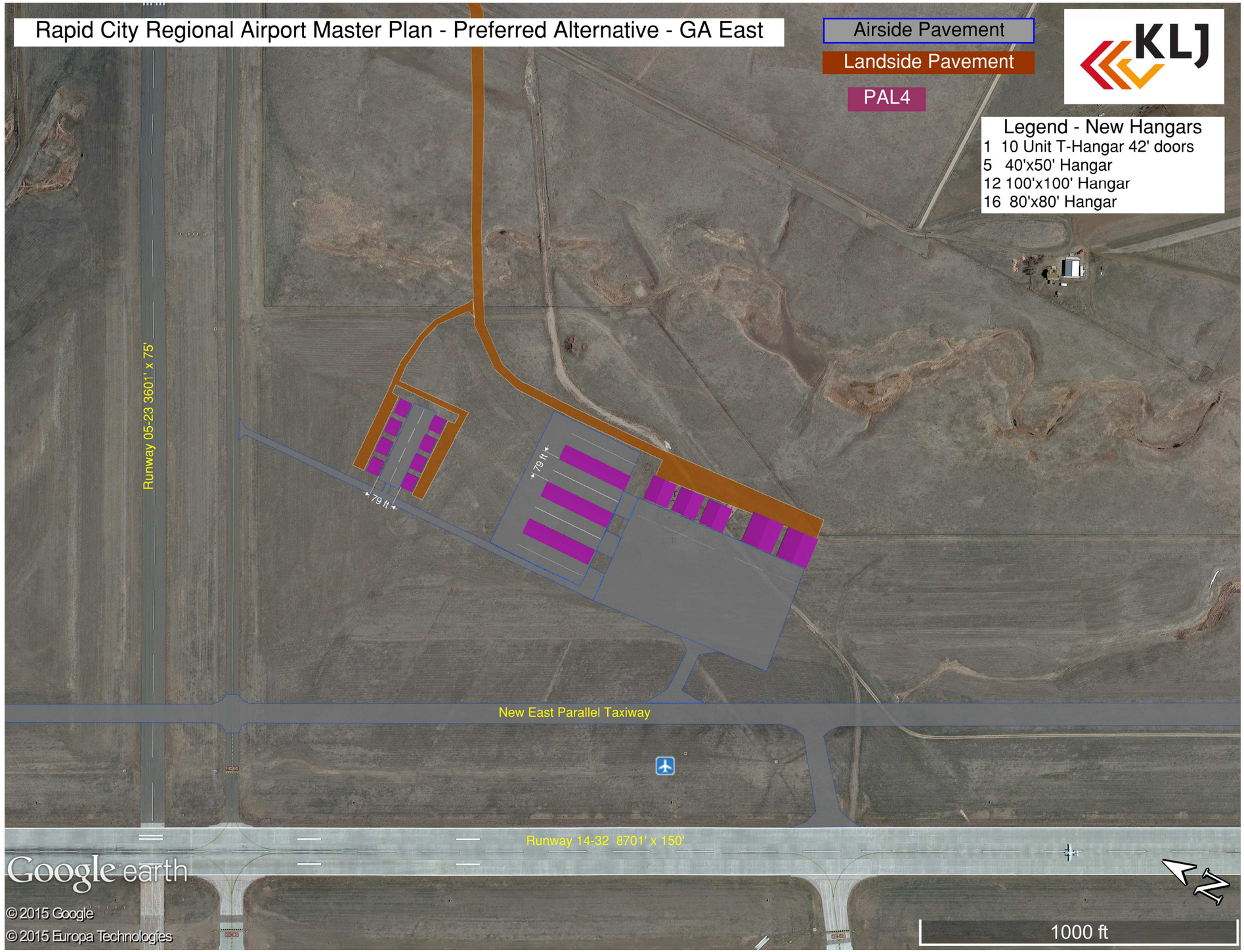


Exhibit 5-17 Preferred Alternative - GA East



Air Cargo

The air cargo area at Rapid City is considered a vital component of the airport. As a regional destination point for two cargo airlines and the USPS, accommodating future growth needs at the airport is important. The following section summarizes air cargo facility requirements:

- **Provide an initial 5,700 SY of air cargo apron with an estimated need up to 9,000 SY through the planning period.**
- **Provide an area for sorting and hangar facilities in the vicinity of the apron area.**

The critical design aircraft is an ATR 42, an Airplane Design Group III airplane with Taxiway Design Group 2 standards. Through PAL 4, approximately 57 percent more apron space will be required to meet forecast demand.

Several air cargo development concepts were evaluated to best accommodate the facility requirements considering the existing infrastructure and constrained environment. The existing site is adjacent to the old terminal and is subject to repurposing as a part of this Master Plan process.

Air Cargo Alternative 1

Alternative 1 is near the existing cargo area and includes a 65' x 120' cargo building. The apron would be 7,800 square yards which would require using the existing deicing apron. See **Exhibit 5-1 Alternative 1.**

Air Cargo Alternative 2

Alternative 2 is near the existing cargo area and includes a 65' x 120' cargo building and a 80' x 80' hangar. The apron would be up to 8,100 square yards which would use the existing deicing apron. See **Exhibit 5-2 Alternative 2.**

Air Cargo Alternative 3

Alternative 3 is to the south near the USFS tanker facility and includes a 65' x 120' cargo building. The apron would be up to 4,900 square yards including a Customs and Border Protection facility which would use the same apron. See **Exhibit 5-3 Alternative 3.**

Table 5-14 – Air Cargo Alternative Evaluation

Alts	Actions	Strengths	Weaknesses
No Change	No Action	• Minimal investment	• This is not an option as the area has been
1	Southeasterly facing facility near existing area	• Uses portions of existing apron • Least costly alternative	• Loss of Deicing area
2	Northeasterly facing facility near existing area	• Uses portions of existing apron • Includes a Hangar	• Loss of Deicing area for expansion
3	New cargo area near USFS air tanker base	• Adjacent to CBP facility • Sufficient room for expansion	• Requires new roads, apron and taxilanes to function • Highest cost alternative

Preferred Alternative

The preferred alternative is Alternative 2 because of its ability to meet needs and not impede into airline terminal area. See **Exhibit 5-4 Preferred Alternative.**

Military Facilities

Recommended development of SDARNG facilities are driven by their own facility master plan studies. These facilities have a lease with the airport through at least 2056; beyond the planning period for this study.

The boundary for the SDARNG facilities are not proposed to change. The SDARNG facility master plan proposes to add a Readiness facility within the existing leased area and modify the entry point to the SDARNG facility.

It is recommended that the airport continue to coordinate with the SDARNG to assure that the Army National Guard and all other users can operate effectively with each other. Some uses by the SDARNG are non-aeronautical in nature and for these areas a lease of fair market value is required.

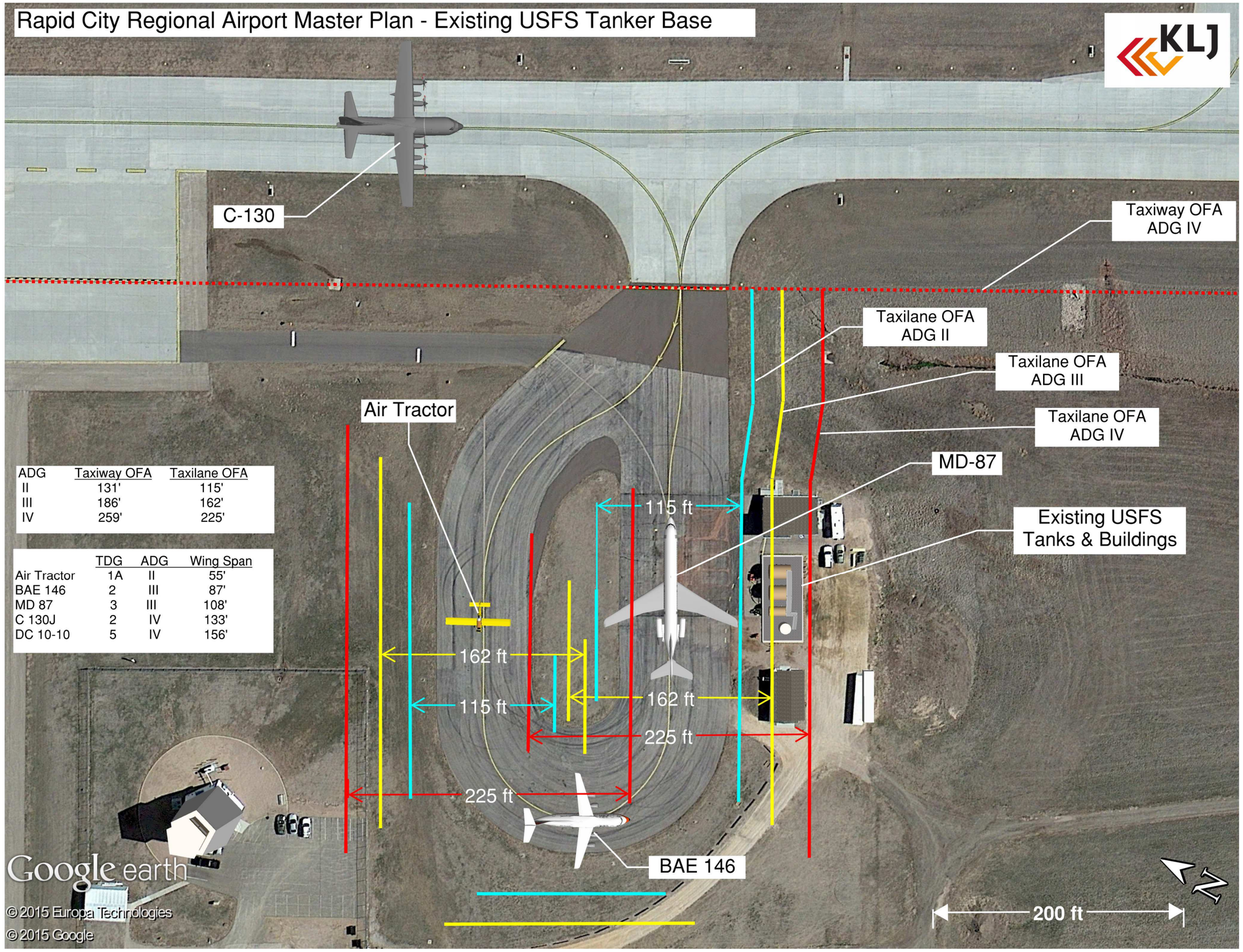
USFS Air Tanker Base

The needs for the U.S. Forest Service are determined by the operational needs for the air tankers. The tankers contracted by the USFS are changing and generally becoming larger. To accommodate these changes the alternatives included supporting aircraft up to a DC-10 aircraft but were generally developed to support MD-87 and C-130 aircraft. Since the USFS operation is a federally funded activity, the Federal Aviation Administration restricts the use of Airport Improvement Program (AIP) funding to cover these USFS improvements. It will therefore be necessary to use sources other than AIP to complete any improvements.

No Change

The no change scenario is one that continues to be considered for the USFS Air Tanker Base. To help depict the issues with a no change scenario **Exhibit 5-18 USFS Existing Conditions** provides information relative to the aircraft expected to use the Air Tanker Base.

Exhibit 5-18 USFS Existing



Alternatives 1 & 2

Alternatives 1 & 2 are identical and were selected by the USFS as their preferred option. This alternative would continue to use existing tanks in place. One loop would be modified using the existing pavement for single engine aircraft and one new loop would be constructed for large aircraft up to DC-10 with 3 possible loading pads. See **Exhibit 5-2 Alternative 2.**

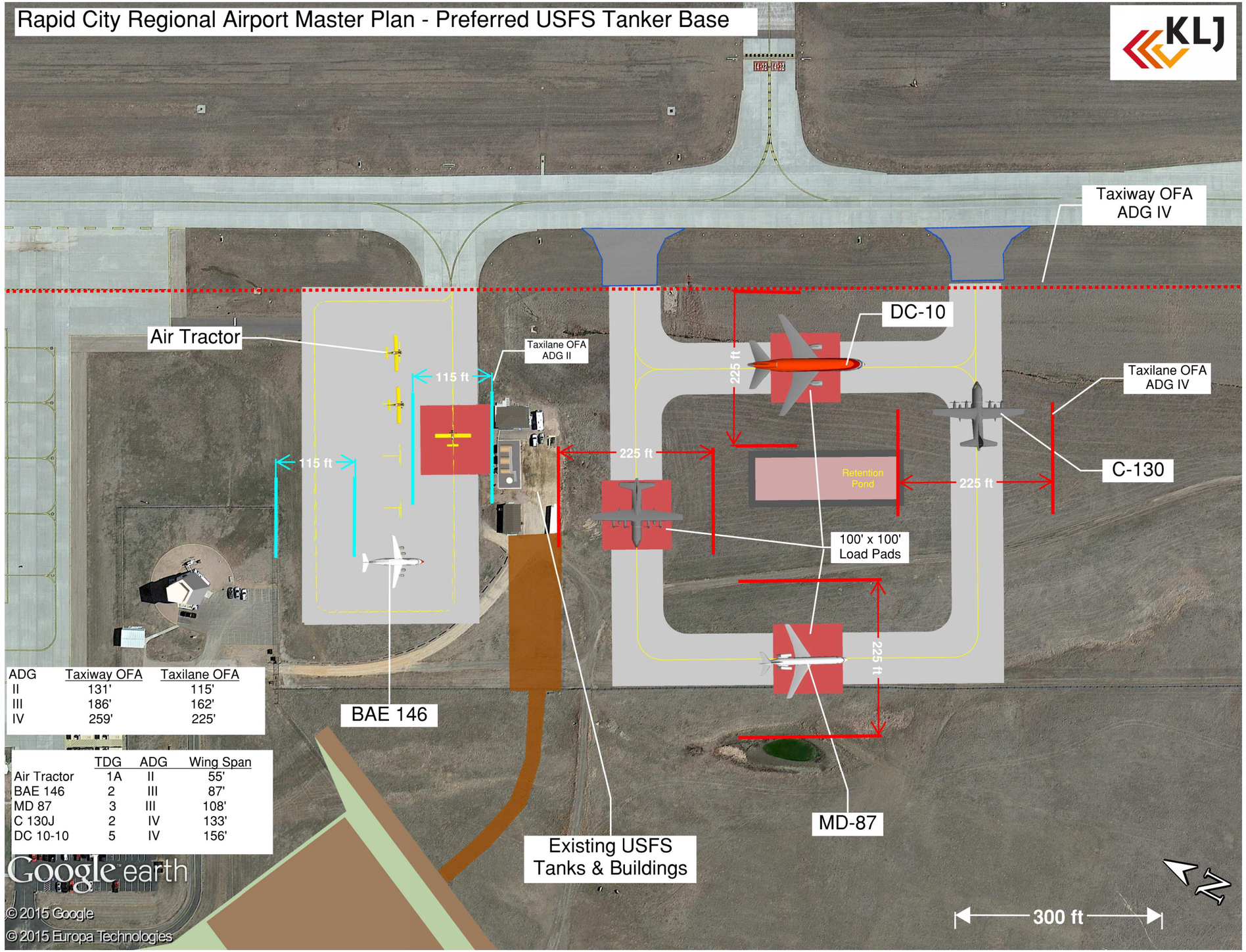
Alternative 3

Alternative 3 was another option prepared for the USFS to consider. It included two loops for large aircraft up to DC-10 using a new tank and building area. See **Exhibit 5-3 Alternative 3.**

Preferred Alternative

The preferred alternative selected by the Airport Board included the improvements identified in Alternatives 1 & 2. See **Exhibit 5-19 Preferred Alternative – USFS Air Tanker Base.**

Exhibit 5-19 USFS Preferred Alternative



Landside Development Alternatives

Parking Requirements

In general there is sufficient space for public parking, but it was found there was a lack of space for rental car storage. The alternatives looked at different options to add parking from a long term stand point and to address the lack of rental car storage.

Alternative 1

Alternative 1 has two lower terraced parking areas added to the north and west of the current car rental area adding approximately 160 new spaces. A single story parking garage (approx. 340 new spaces) would be added in front of the airline terminal. See **Exhibit 5-1 Alternative 1.**

Alternative 2

Alternative 2 has a lower terraced parking area added to the west of the current car rental area adding approximately 110 new spaces. A single story parking garage (approx. 260 new spaces) would be added over the existing car rental area. See **Exhibit 5-2 Alternative 2.**

Alternative 3

Alternative 3 adds no public parking or rental car parking. See **Exhibit 5-3 Alternative 3.**

Preferred Alternative

The preferred alternative for parking is the terraced parking from Alternative 2 for rental car storage and a new surface lot south and east of the existing surface lots but remaining inside the Terminal Road loop. See **Exhibit 5-20 Preferred Alternative.**

Non-Aeronautical Development Area

There are portions of the airport that do not have access to the airfield which can otherwise be used for other development. This is often used for non-aeronautical development and therefore areas were identified which could be used in this manner. All non-aeronautical development is required to be shown on the Airport Layout Plan and approved by FAA.

Alternative 1

A business park area would be constructed with access off of Terminal Road. The access point would be where the one-way Terminal Road has a T-intersection back with the beginning portion of Terminal Road. See **Exhibit 5-1 Alternative 1.**

Alternative 2

A business park area would be constructed with access off of RTR Road. The area would be bound by Terminal Road on the south, east and west sides. See **Exhibit 5-2 Alternative 2.**

Alternative 3

No business park area was added. See **Exhibit 5-3 Alternative 3.**

Preferred Alternative

The preferred alternative for Non-Aeronautical Development was Alternative 1. This provided the largest amount of development area without impeding terminal area parking. See Exhibit 5-20 Preferred Alternative.

Support Facility Alternatives

Fueling Facilities

The existing fuel farm is sufficient through the planning period. Additional tanks can be added as the FBO requires. The realignment of WestJet Drive may require some changes to the fuel farm area. Any changes will be identified as the design process for WestJet Drive is conducted.

Aircraft Rescue and Fire Fighting (ARFF)

The ARFF station is owned by the airport and staffed by firefighters from the City of Rapid City. There are no changes needed for this facility.

Airport Maintenance & Snow Removal

The airport maintenance/snow removal facility is situated in an area that is ideally suited for hangar development. It is recommended by PAL 3 that a new facility be constructed to open up this area for hangar development. Alternatives 1 and 2 depict the new location for the airport maintenance/snow removal equipment facility.

The preferred alternative for airport maintenance/snow removal facility was determined to be that shown in Alternatives 1 and 2. See **Exhibit 5-20 Preferred Alternative.**

Customs and Border Protection (CBP)

A CBP General Aviation Facility was identified as a need for Rapid City. Each alternative included a CBP facility. Alternatives 1 and 2 used a portion of the current TSA office building for the CBP facility. Alternative 3 located a CBP facility with Air Cargo near the current USFS Air Tanker Base to the south.

The preferred alternative for CBP was determined to be that shown in Alternatives 1 and 2. See **Exhibit 5-20 Preferred Alternative.**

Security Fencing & Wildlife Control

There are no recommendations for changes in security fencing or wildlife control other than to maintain the existing facilities.

Internal Perimeter Road

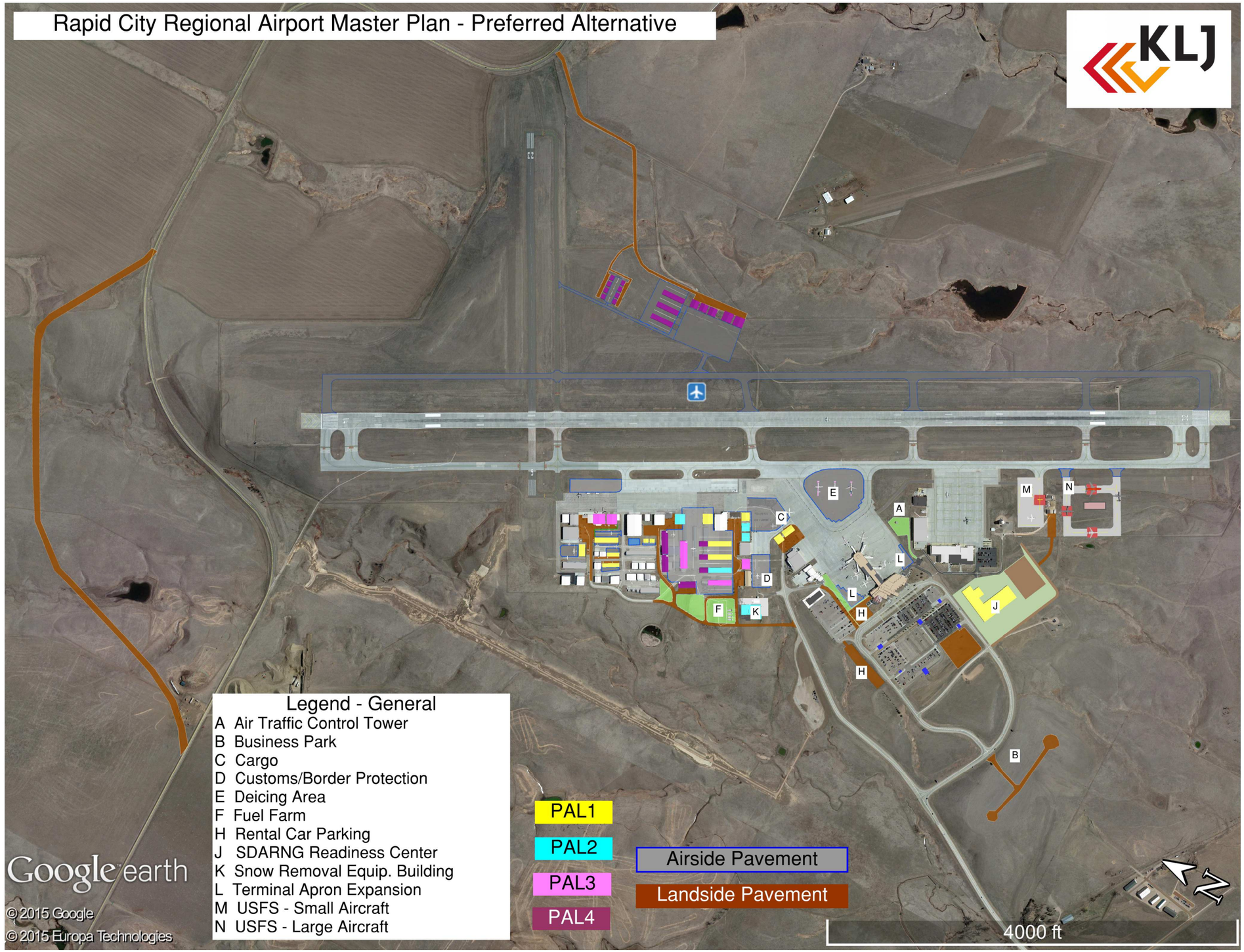
An internal perimeter road provides secure airside access for authorized vehicles and minimize the need to cross active runways and taxiways. The current perimeter road is paved for a small portion around the Rapid City airport. The remaining portions are a mixture of all weather and trail. It is recommended that the airport continue to add material to create all weather roads around the perimeter and have the roads paved when they are within 400 feet of connecting with any airfield pavement.

Airport Utilities

The location and type of airport utilities for facility development will be considered at the time of facility development. Development must consider the location and capacity of water main lines to assure sufficient fire protection is in place. The existing water system and city building codes will have an effect on the types of construction for buildings at the airport.

The sanitary sewer facility for the airport currently is a lagoon system. Connection to the City of Rapid City's water reclamation facility should be included in the airport's long term plans and coordinated with the City.

Exhibit 5-20 Preferred Alternative



Preferred Development Strategy

Table 5-15 Preferred Development Strategy presents a draft phasing plan. This serves as an overall summary of the preferred alternatives for each functional area. This plan is subject to change from refinements in the **Chapter 6: Implementation Plan** based on Airport Capital Improvement Plan (AICP) financial considerations. The timing of improvements based on Planning Activity Levels should be adjusted accordingly should activity levels change from the approved forecast. The strategy assumes facility maintenance and rehabilitation will be completed as necessary.

Table 5-15 – Preferred Development Strategy

	Near-Term 0-5 Years PAL 1	Mid-Term 6-10 Years PAL 2	Long-Term 11-20 Years PAL 3 & 4	Ultimate 20+ Years Beyond PAL 4
Airfield	• Replace PAPIs • Remove Taxiway B between the Apron and Taxiway A	• Realign Long View Road outside of Runway 14 RPZ • Precision Instrument Approach for Runway 14 • Replace ATCT	• Add 25' paved shoulders for Runway 14-32 • Expand Blast Pad for Runway 32 to 200' x 200'	• Construct East Parallel Taxiway for Runway 14-32
Passenger Terminal	• Add inline Baggage Screening • Add new Baggage Makeup Area • Deicing Apron Phase I (2 positions)	• Expand terminal apron to square off corners	• Deicing Apron Phase II (1 position)	
General Aviation & Other	• Add 3 10-unit T-Hangars • Add 3 conventional hangars • Add 9 small box hangars • Add Cargo Building and Cargo Hangar • USFS Phase I	• Expand Apron on North end by 7,000[7] square yards • Add 1 10-unit T-Hangar • Add 2 Conventional Hangars • SDARNG Readiness Center • USFS Phase II	• Add 1 10-unit T-Hangar • Add 3 3-unit T-Hangars • Add 3 Conventional Hangars • Add 1 8-unit Exec T-Hgr • Add 10 small box hangars • USFS Phase III	East Side • Add 22,500 square yards of apron • Add 5 Conventional Hangars • Add 3 10-unit T-Hangars • Add 8 small box hangars
Landside	• Public Parking Lot Entry/Exit Shelters	• Realign Road for Rental car lot (for Terminal Apron expansion) • Pave Additional public parking • Add storage lot for rental cars	• Site work for non-aeronautical area	
Support	• New General Aviation Road	• Relocate Maintenance and SRE facilities • Sanitary Sewer connection	• Prepare CBP facility	

Source: KLJ Analysis

[7] The Runway Visibility Zone would restrict some of this apron unless the threshold to Runway 5 were relocated by at least 105 feet. Any relocation of the Runway 5 threshold must consider the close proximity of Taxiway A and Runway 14-32 as well as issue of removing any direct taxiway connections from the apron to Runway 5 and 14-32.

Chapter 6: Implementation Plan

Introduction

A plan for the recommended future airport development was identified in **Chapter 5: Alternatives Analysis** based on the existing conditions, aviation forecasts and facility requirements. The improvements needed at the Rapid City Regional Airport over the next 20-year period have been determined.

The implementation plan provides guidance on how to implement the preferred development recommendations from this Master Plan. This chapter includes the following sections:

- Considerations
- Implementation Summary
- Implementation Process
- Project Phasing & Descriptions
- Financial Overview
- Capital Improvement Plan

Considerations

Each project is sequenced to balance demand, schedule, other projects, environmental/agency approval, funding and financial constraints. The project plan may change over time to react to changing conditions, but is flexible so that the airport can react to change and re-prioritize projects based on actual demand.

The implementation plan is divided into four phases:

- Short-Term (2015 through 2019)
- Mid-Term (2020 to 2024)
- Long-Term (2025 to 2033), and
- Ultimate (beyond 2033)

The short-term phase accounts for the first five years of projects since the Master Plan began in 2014. Many of these projects are in process. A more detailed facility implementation and financial feasibility plan is identified for the short-term and mid-term as the project needs can be more realistically anticipated based on available funding and actual activity demand. After this phase there is more uncertainty in project funding, demand and local project importance.

All planning-level project costs developed are in 2015 dollars. Final project costs are subject to change based on actual construction and project formulation needs.

Many of the projects identified are demand-driven based on the Planning Activity Levels (PALs) from the approved aviation forecasts. Each PAL corresponds to an estimated year. The timing of implementation is estimated from the FAA-approved activity forecasts. Any change in the actual airport activity and forecasts may affect the timing of these improvements. For example, a higher design hour departing passenger count from changes in flight schedule may require terminal expansion planning to begin sooner than anticipated requiring a quicker implementation schedule than anticipated. Projects are implemented based on actual demand.

The development strategy it vital to creating a realistic implementation plan. These considerations for the Rapid City Regional Airport include:

- Maintain a safe airport. Address key safety/security/standards projects while providing adequate funding for other necessary improvements.
- Maintain airport pavements and facilities in a functional condition. Priority projects in the short-term includes the reconstruction and expansion of apron areas.
- Build capacity at the airport to meet growing demands. Key projects include the construction of an inline baggage screening system and baggage makeup area, a new access road to the General Aviation area to allow for new hangar development, reconfiguring the USFS facility for larger aircraft and meeting the aeronautical needs of corporate and air cargo users.
- Sequence airport improvement projects considering a realistic funding plan with a mix of federal, state and local funds. Consider available grant funding and maintain adequate reserves in the airport enterprise fund balance for unforeseen events.

For this implementation plan, projects fall into one of four main categories:

- **Airfield (A)** – all projects within the aircraft movement area or are otherwise necessary for the landing and takeoff of aircraft at the airport.
- **Terminal Area (T)** – projects which are within the terminal building, surrounding terminal area or directly serve the scheduled airline passengers such as parking, rental car or other terminal tenants.
- **General Aviation & Other Areas (G)** - projects which are often demand driven based on different airport users. These projects include the airside and landside elements necessary to meet these user needs.
- **Landside & Support (L) – projects which are only on the landside of the airport or otherwise provide support to airport operations.**

Based on the PALs and other regular pavement and safety needs, some airport development capacity projects may not able to be sequenced to meet PALs within a realistic funding plan.

These projects are initiated within a few years of their PAL demand trigger to account for anticipated available funding.

Implementation Summary

Recommended infrastructure projects are identified in one of the four development periods. These projects are then prioritized and sequenced based on a variety of factors previously described including demand triggers, scheduled improvements and available funding. The actual implementation will vary depending upon demand and financial considerations. Each project identified requires detailed planning, environmental documentation, design and construction steps prior to its completion.

Implementation Process

Once funding has been identified, the airport must go through an established process to receive the federal funds to complete an airport development project. FAA requires long lead times to complete all project steps and incorporate projects into funding plans. Additional coordination is required to prepare National Environmental Policy Act (NEPA) environmental documentation. Common steps in the project implementation process for a complex project include:

- Professional Services: Select a qualified consultant / engineer for the project planning, survey, design, construction administration, or environmental reviews for the project.
- Five (5) Years Prior to Construction: Update the Capital Improvement Plan (CIP) to identify the project scope, eligibility, justification and funding. Close coordination with FAA is required.
- Four (4) Years Prior to Construction: Assure the project is identified on the Airport Layout Plan, complete necessary airport planning studies and collect supporting documentation to demonstrate the project is justified for AIP funding, and is compatible with the Airport Layout Plan.
- Three (3) Years Prior to Construction: Initiate any aeronautical surveys, navigational aid agreements (reimbursable agreements) or special FAA coordination for flight procedures which may be necessary prior to construction. Solidify project funding plan and final justification with FAA.
- Two (2) Years Prior to Construction: Complete required NEPA environmental documentation and analysis for the proposed action. Prepare 30 percent project design, refine cost estimates and prepare benefit/cost analysis as necessary. Acquire land for project and initiate airspace studies.
- One (1) Year Prior to Construction: Obtain environmental clearance and permits for the proposed action. Prepare detailed project plans and specifications including

design report, airspace studies, Safety Management Systems (SMS) and construction safety/phasing plan. Finalize project schedule.

- Year of Construction: Complete final design. Solicit bid proposals from companies engaged in the project construction. Prepare grant application and accept Federal grant. Issue notice to proceed and monitor construction. Maintain FAA grant compliance and payments.
- After Construction: Submit final report and close out the AIP grant.

For complex projects requiring federal discretionary funding such as runway extensions, these steps may take up to five years prior to the issuance of an AIP grant for construction. Less complex projects using entitlements such as pavement rehabilitation will require less lead times, typically no less than three years prior to grant issuance.

Project Phasing & Descriptions

Summary

The recommended project phasing at Rapid City Regional Airport is based on anticipated needs and available funding. A more detailed review of the short-term and mid-term is completed as airport standards, demand and local priorities change over time which require updated planning and re-evaluation. Long-term and ultimate projects are identified for airport planning purposes based on forecasted needs.

Short-Term Projects (0-5 Years)

Short-term projects cover the beginning of the planning period for the next five years through 2019 or forecasted PAL 1. The identified sequencing is based on years because activity and funding can be reasonably anticipated. Projects also require actions to be taken several years ahead of implementation, requiring a solid project and funding plan to be developed for projects within the next five years.

Projects in this phase are primarily sequenced based on demand. Projected funding sources are based on current legislation and forecasted activity levels including FAA AIP (passenger entitlement and discretionary at 90 percent), State funding (AIP match at 4 percent) and local funding sources (airport operating fund, Passenger Facility Charge and Customer Facility Charges). Local funds are allocated to match AIP funds and the highest priority short-term projects which are not eligible for AIP funding.

At Rapid City the notable short-term projects, many of which will be demand driven, are as follows:

Table 6-1 – Notable Short Term Projects

Rapid City Regional Airport – Notable Short-Term Projects		
Project	**Description**	**Cost/Funding**
Small Hangar Construction/Acquisition (2016)	This is the first of several projects to provide small hangars at the airport owned by the airport. The hangars are suited for Group I aircraft (T-Hangars and other small boxed group hangars). The project includes acquisition of an 8 unit T-Hangar and a new 10 unit T-Hangar.	Estimated: $887,100 *Local Share: $887,100*
Deicing Apron (2017)	The first phase of the deicing apron will be construction of a new apron for deicing as a turnout from taxilane T1 and connecting directly to taxiway A. The first phase will be sufficient for one Group III aircraft.	Estimated: $1,480,700 *FAA Share (90%): $1,332,630* *State Share: $59,228* *Local Share: $88,842*
Rental Car Storage Lot (2017)	As identified in the Master Plan, there is a deficiency in storage space for rental cars. This project will complete a portion of this area which will be terraced adjacent to terminal road.	Estimated: $570,000 *Local Share (CFC): $570,000*
USFS Air Tanker Base (2017)	The USFS is using larger aircraft for aerial firefighting than the Rapid City Tanker Base was designed to handle. This project is phase 1 and will use the existing tanks and buildings and add a loading pad and taxilane loop, with fill material, for larger USFS contracted aircraft.	Estimated: $3,532,500 *Other Source (USFS): $3,532,500*
Cargo Apron and Building (2017)	A new area for air cargo operators will be constructed using a portion of newly constructed apron near the old terminal and an infill of apron. There will also be constructed a new building suited for air cargo and truck parking.	Estimated: $1,310,000 *FAA (90% of apron): $455,400* *State Share: $20,240* *Other Source: $804,000* *Local Share: $30,360*
Baggage Makeup and In-line Baggage Screening (2018)	Design and install a new in-line baggage screening system with an outbound baggage make-up carousel. The system will include the enclosure of 9,900 sf of area under the existing concourse and approximately 575 lf of baggage conveyor and 130 lf of baggage carousel.	Estimated: $5,166,900 *TSA (eligible portion): $1,300,000* *Local Share: $3,866,900*
New General Aviation Road (2018)	A new road constructed west of the existing Airport Road. The 2,300 lf of road includes a new alignment and connections with WestJet Drive and LaCroix Court. This will allow for the relocation of the SRE facilities. The road realignment and relocation of the SRE facilities will open up approximately 7 acres for aviation development.	Estimated: $1,191,400 *FAA Share (90%): $1,072,260* *State Share: $71,484* *Local Share: $47,656*
Small Hangar Construction (2018)	This is the second project in the planning period to provide for small hangars at the airport, owned by the airport. The project includes construction of a 4 unit small box hangar and a 10 unit T-Hangar.	Estimated: $1,135,700 *Local Share: $1,135,700*
Realign Long View Road (2019)	Relocate Long View Road outside of the Runway 14 RPZ to improve the instrument approach to a Precision Approach.	Estimated: $1,737,000 *FAA Ent/Discr: $1,563,300* *State Share: $104,220* *Local Share: $69,480*

Mid-Term Projects (6-10 Years)

Mid-term projects cover the planning period for the next six to ten years through 2024 or forecasted PAL 2. The identified sequencing is still based on years. Although the sequencing can be more fluid than the short-term, mid-term projects can still be reasonably anticipated based on project activity and funding. Again, projects require actions to be taken several years ahead of implementation so a project plan out 10 years should be established. Projects in this phase may change sequence, however the bulk of the identified projects need to be implemented unless an unforeseen event occurs that changes the basis for the plans developed.

Projects in this phase are sequenced based on anticipated needs, but also consider demand-driven projects. These are needed to meet activity thresholds triggered between PAL 1 and PAL 2 in the mid-term. Projected Federal, State and local funding sources are still based on current legislation and forecasted activity levels. Local funds are allocated to match AIP funds and the highest priority projects which are not eligible for AIP funding.

At Rapid City the notable short-term projects, many of which will be demand driven, are as follows:

Table 6-2 – Notable Mid-Term Projects

Rapid City Regional Airport – Notable Mid-Term Projects		
Project	**Description**	**Cost/Funding**
Precision Instrument Approach for Runway 14 (2020)	This project will improve the approach to Runway 14 to a Precision Instrument Approach by adding a Localizer, Glide Slope Antenna, MALSR and lowering terrain which penetrate the protective surfaces.	Estimated: $2,960,000 *FAA Ent/Discr: $2,664,000* *State Share: $118,400* *Local Share: $177,600*
Sanitary Sewer Line to Rapid City Lift Station (2021)	Install a sanitary sewer line to connect to a Rapid City sanitary sewer lift station. This connection to Rapid City's Sanitary Sewer system will eliminate the need for the airport to maintain a sewer lagoon system.	Estimated: $800,000 *Local Share: $800,000*
Expand North Apron Area (2023)	The north apron area will be expanded to the east matching the depth of the other portions of the general aviation apron.	Estimated: $1,017,000 *FAA Share (90%): $915,300* *State Share: $40,680* *Local Share: $61,020*
Runway 14-32 Rehab, Paved Shoulders & Runway 32 Blast Pad (2023)	The runway will be rehabilitated correcting any pavement failures. 25' paved shoulders will be added and the Runway 32 blast pad will be expanded to meet design standards.	Estimated: $7,560,000 *FAA Ent/Discr: $6,804,000* *State Share: $302,400* *Local Share: $453,600*
Replace ATCT (2023)	Replace the existing ATCT in a new location between the Airline Terminal and SDARNG to improve visibility and update the facility.	Estimated: $3,513,000 *FAA Share: $2,500,000* *Local Share: $1,013,000*
Replace SRE/Maintenance Facility (2024)	The existing SRE/Maintenance buildings will be removed to make space for GA development and a new SRE/Maintenance facility will be constructed near the existing electrical vault.	Estimated: $9,500,000 *FAA Share (90%): $8,550,000* *State Share: $380,000* *Local Share: $570,000*

Long-Term & Ultimate Projects (PAL 3-4 and beyond)

Long-term and Ultimate projects cover the remainder of the planning period for the next 11 to 20 years through year 2033 and beyond or forecasted PAL 3 and 4. Projects are identified based on forecasted project activity and funding. The project sequencing for demand driven projects in this phase may change as a result of change in aviation activity, new standards, funding or even new local priorities. Long-term projects are important to consider in airport master planning so that appropriate steps, funding and resources can be allocated. Additionally, it allows the ability for the airport to react to changes in airport activity.

In this phase, only significant pavement reconstruction projects are described as their schedules are not typically flexible and funding needs tend to be higher. Projects in this phase are based on future standards and anticipated demand-driven needs. Demand projects are required to adequately meet activity thresholds triggered between PAL 3 and PAL 4. Projected Federal, State and local funding sources continue to be based on current legislation and forecasted activity levels. Local funds are allocated to match AIP funds and the highest priority projects not eligible for AIP funding. Because of changing considerations, actual funding needs are likely to vary between the completion of this master plan study and the long-term.

Long-term and ultimate project priorities tend to change over time. A change in activity from the forecasts, for example, will require modification to the demand/capacity projects implementation schedule and available passenger entitlement funding. It is important however for the airport to identify potential needs and be prepared to react accordingly.

Table 6-3 - Notable Long Term/Ultimate Projects

Rapid City Regional Airport - Notable Long Term/Ultimate Projects		
Project	**Description**	**Cost/Funding**
Expand Deicing Apron (2029)	Add two more deicing positions to the deicing apron area bringing the total to three permanent deicing positions all capable of handling up to Aircraft Design Group III.	Estimated: $2,000,000 *FAA Share (90%): $1,800,000* *State Share: $80,000* *Local Share: $120,000*
Construct East Parallel Taxiway (ultimate)	Add a full parallel taxiway on the east side of Runway 14-32. The taxiway will be separated sufficiently from the runway to serve as a temporary runway during the reconstruction of the primary runway.	Estimated: $21,435,500 *FAA Share: $19,291,950* *State Share: $857,420* *Local Share: $1,286,130*

Financial Overview

The implementation plan considers the airport's ability to fund the projects identified in the master plan. Projects in the short-term and mid-term are discussed in more detail for realistic project sequencing based on identified needs, airport priorities and available funding. Financial feasibility is a major consideration in developing the implementation plan and Capital Improvement Plan (CIP).

Sources of Funding

Airport funding for projects is derived from many sources. Funding sources can be categorized into three main categories:

- Federal funding
- State funding
- Local or Private funding
- Non-traditional funding

A detailed description of each of these funding sources is provided in **Appendix E – Airport Funding**. The funding that is planned for Rapid City is summarized as follows:

Federal

Most funding for airport development comes from federal government programs. Currently the most predominant program is the Airport Improvement Program, commonly referred to AIP, managed by the Federal Aviation Administration (FAA). Although there are some exceptions, the current legislation limits the federal share of allowable AIP costs at 90 percent for most non-hub primary or smaller airports. The remaining 10 percent is considered the local share. In South Dakota, the State provides a 4 percent match with all AIP funds leaving the airport sponsor with a 6 percent share of the project cost.

Primary Entitlements

These funds are available to airports with scheduled passenger service and enplaning more than 10,000 passengers per year. Rapid City Regional Airport is eligible to receive passenger entitlements. Based on 2013 data, Rapid City Regional Airport is eligible to receive $2,151,000 in passenger entitlements through AIP in 2015. Although that amount is subject to annual Congressional appropriations, it is reasonable to expect continued funding at this level for the duration of the current FAA reauthorization law, which extends through 2015.

Discretionary

Discretionary funding is used for higher priority AIP funded projects where passenger entitlements are not sufficient to cover the total federal share. Most AIP-eligible projects would be eligible for discretionary funding. However, the assignment of discretionary funds is determined by the FAA, and extensive coordination with the FAA is required to determine the potential availability of discretionary funding for specific projects. Individual projects are given a weighted National Priority Rating based on project purpose, type, component and airport type. As one of two non-hub or small hub airports in South Dakota, Rapid City would rank high in this component. Safety and preservation projects of AIP funded runways rank the highest, but are ranked against other projects and facilities regionally and nationally.

In-depth discussions with FAA representatives are necessary to determine the potential availability of discretionary funding for an AIP-funded project.

State

State funding for airport development is managed by the South Dakota Department of Transportation's Office of Aeronautics, under the direction of the South Dakota Aeronautics Commission. This funding, held in the South Dakota Aeronautics Fund, comes primarily from aviation fuel taxes and aircraft registration fees.

Airports may apply for funds to cover up to 40 percent of the local share for federal AIP-funded projects. Airports are also allocated a portion of the aviation fuel taxes collected from fuel sales on their airport and may request those funds for airport development projects including equipment.

The State of South Dakota currently provides a 4 percent match for AIP funded projects. This funding source has been factored into AIP-funded projects. Additional funding opportunities for airport improvements is available through the State. This funding source is recommended to be utilized for non-AIP eligible equipment.

Local

An airport does not typically satisfy its capital development needs with internal funding sources alone. Federal, state, and private funding, together with airport funds and bond proceeds, are usually combined to produce the total funds required for capital projects.

Passenger Facility Charge

The Aviation Safety and Capacity Expansion Act of 1990 authorized the Secretary of Transportation to grant public agencies the authority to impose a Passenger Facility Charge (PFC) to fund eligible airport projects. The current cap on PFC is $4.50 per revenue passenger. Rapid City imposes at $4.50 PFC on passengers and the revenue is currently dedicated to the payment of debt for the Airline Terminal renovations completed in 2013. **Table 6-4** shows the current status of the Bonded Indebtedness for the terminal renovation.

Table 6-4 -Airline Terminal Renovations Debt

Airline Terminal Renovations Debt - Series 2011 PFC Funded for $11,675,000 in Debt					
	Outstanding Principal	**Remaining Interest**	**Interest Rate**	**Approximate Annual P&I**	**Approximate Annual PFC Revenue**
As of 7/1/2015	$10,850,000	$9,078,700	3.75% to 7.00%	$967,000	$1,060,000
Last Payment scheduled for 12/1/2035					
Callable at par on 12/1/2019					

Source: Dougherty & Company LLC

Customer Facility Charge

A customer facility charge (CFC) is in place at Rapid City for on-airport rental car agencies. The funds are collected by the rental car agency from their customers and then paid to the airport. The majority of these funds are currently used to pay the debt service on the Quick

Turn Car Rental Facility completed in 2014. The remaining funds can be used for any other capital project related to the Rental Car facilities such as parking or building improvements. **Table 6-5** provides information regarding the current status of the debt on the Rental Car facility.

Table 6-5 -Rental Car Quick Turn Facility Debt

Rental Car Quick Turn Facility Debt - Series 2010 CFC Funded for $4,210,000 in Debt					
	Outstanding Principal	**Remaining Interest**	**Interest Rate**	**Approximate Annual P&I**	**Approximate Annual CFC Revenue**
As of 7/1/2015	$3,705,000	$2,382,400	6.00% to 7.00%	$390,000	$610,000
Last Payment scheduled for 12/1/2030					
Callable 12/1/2020-11/30/2021 at 102%; 12/1/2021-11/30/2022 at 101%; and at par after 12/1/2022					

Source: Dougherty & Company LLC

Other Airport Funds

The remaining portion of project costs must be funded from the annual cash flow at the airport or with unrestricted cash balances available to the airport.

There are some project which may require full funding from airport funds. These projects, such as small hangars, can provide the airport an ongoing revenue stream. In addition since small hangars are more efficiently constructed as a group it also is an ideal project type for the airport to take on to assure the airport land is used most efficiently.

Private Funds

There are many projects, primarily larger hangars which will be for the purpose of benefiting an individual or company. Since demand for these structures is very specific it is recommended that private funding be the means to construct these facilities. Land should be leased to the entity to build the hangar with provisions that all improvements revert fully to the ownership of the airport following a reasonable period for the entity to amortize the initial improvements.

Non-Traditional Funding Sources

These include any other non-aeronautical funding sources that may be available for airport development. Other government agencies such as Transportation Security Administration (TSA), US Forest Service (USFS), South Dakota Army National Guard (SDARNG) or Customs and Border Patrol (CBP) may also provide portion of funding for airport improvements.

Capital Improvement Plan

The Capital Improvement Plan (CIP) is the key outcome of the implementation plan. The CIP as prepared based on the Airport Master Plan is provided in **Table 6-6**. The CIP is subject to change on an annual basis and it is recommended in subsequent years to the Master Plan being completed that a reader contact the Rapid City Regional Airport for the most current CIP.

Table 6-6 – Capital Improvement Plan

PROJECTS CURRENTLY UNDERWAY (2015)								
		Starting Entitlement Balance:	$1,432,890	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	FAA	FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2015	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Commercial Service and North GA Apron Rehab Design	$99,990	$89,991		$5,999		$4,000	
	PAPI Replacement (Both Runways)	$359,500	$323,550		$21,570		$14,380	
	Apron Expansion (Phase 1) Terminal Demolition	$535,590	$482,031		$32,135		$21,424	
	Apron Expansion (Phase 2) Midfield Apron Paving	$1,605,450	$1,444,905		$96,327		$64,218	
	SRE - 2 Plow Truck - 1 High Speed Plow	$677,300	$609,570		$40,638		$27,092	
	TOTAL	$3,277,830	$2,950,047	$0	$196,670		$131,113	$0
	End of Year Airport Entitlement Balance:		$634,782	Carryover to next year				

REMAINING SHORT-TERM PROJECTS (2016-2019)								
		Starting Entitlement Balance:	$2,806,941	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2016	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Apron Rehabilitation (Old Terminal, GA North, GA WestJet, Commercial Service)	$5,540,000	$2,741,450	$2,244,550	$332,400		$221,600	
	Public Parking Entry/Exit Shelters	$138,000			$138,000			
	Rental Car Entrance Enhancement	$150,000						$150,000
	Acquire 8 Unit T-Hangar [North]	$150,000				$150,000		
	Construct 10 Unit T-Hangar (1 Bldgs) [North]	$737,100				$737,100		
	TOTAL	$6,715,100	$2,741,450	$2,244,550	$470,400	$887,100	$221,600	$150,000
	End of Year Airport Entitlement Balance:		$65,491	Carryover to next year				

Airfield (Rwy, Twy, Apron)
Terminal Area
GA & Other Areas
Landside and Support

Table 6-6 – Capital Improvement Plan (cont.)

		Starting Entitlement Balance:	$2,257,956	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2017	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Construct Deicing Apron (1 aircraft position)	$1,480,700	$1,332,630		$88,842		$59,228	
	Construct Rental Car Storage Lot (Phase I)	$570,000						$570,000
	USFS Phase 1 (Dirtwork and Main loop for large aircraft)	$3,532,500						$3,532,500
	Construct Cargo Apron	$506,000	$455,400	$0	$30,360		$20,240	
	Construct Cargo Building	$804,000						$804,000
	Rehabiltate Hangar Taxilanes	$150,000	$135,000	$0	$9,000		$6,000	
	SRE - Replace Sweeper (Unit #20)	$459,300	$413,370	$0	$27,558		$18,372	
	SRE - Replace Plow (Unit #41)	$250,000	$225,000	$0	$15,000		$10,000	
	Reconstruct Entry Road Shoulders	$900,000			$900,000			
	TOTAL	$8,652,500	$2,561,400	$0	$1,070,760	$0	$113,840	$4,906,500
	End of Year Airport Entitlement Balance:		-$303,444	Carryover to next year				
		Starting Entitlement Balance:	$1,909,851	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2018	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	New Baggage Makeup & In-Line Baggage Screening	$5,166,900			$3,866,900			$1,300,000
	Taxiway A Rehabilitation	$600,000	$540,000		$36,000		$24,000	
	Construct Small Box Hangars (4 units in 1 Bldg) [North]	$398,600				$398,600		
	Construct 10 Unit T-Hangar (1 Bldgs) [Middle]	$737,100						$737,100
	Construct New General Aviation Access Road	$1,191,400	$1,072,260	$0	$71,484		$47,656	
	TOTAL	$8,094,000	$1,612,260	$0	$3,974,384	$398,600	$71,656	$2,037,100
	End of Year Airport Entitlement Balance:		$297,591	Carryover to next year				

Table 6-6 – Capital Improvement Plan (cont.)

		Starting Entitlement Balance:	$2,531,814	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2019	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Construct Cargo Hangar	$515,000						$515,000
	Construct Conventional Hangars (2 Bldgs) [North & Main]	$1,830,000						$1,830,000
	Rehabiltate Hangar Taxilanes	$150,000	$135,000	$0	$9,000		$6,000	
	SRE Equipment Replacement	$600,000	$540,000		$36,000		$24,000	
	Realign Long View Road	$1,737,000	$1,563,300	$0	$104,220		$69,480	
	TOTAL	$4,832,000	$2,238,300	$0	$149,220	$0	$99,480	$2,345,000
	End of Year Airport Entitlement Balance:		$293,514	Carryover to next year				
	REMAINING SHORT-TERM TOTAL:	$28,293,600	$9,153,410	$2,244,550	$5,664,764	$1,285,700	$506,576	$9,438,600
MID-TERM PROJECTS (2019-2024)								
		Starting Entitlement Balance:	$2,548,921	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2020	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Precision Instrument Approach for Runway 14	$2,960,000	$2,664,000		$177,600		$118,400	
	Construct Conventional Hangars (1 Bldg) [South]	$515,000						$515,000
	Construct Small Box Hangars (5 units in 3 Bldgs) [North]	$623,200				$301,200		$322,000
	TOTAL	$4,098,200	$2,664,000	$0	$177,600	$301,200	$118,400	$837,000
	End of Year Airport Entitlement Balance:		-$115,079	Carryover to next year				

Table 6-6 – Capital Improvement Plan (cont.)

		Starting Entitlement Balance:	$2,161,768	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2021	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Runway 5-23 Rehabilitation	$150,000	$135,000		$9,000		$6,000	
	Road Realignment for Rental Car Access	$194,000						$194,000
	Construct Additional Public Parking	$367,000			$367,000			
	Construct Sanitary Sewer Line to RC Lift Station	$800,000			$800,000			
	Update Airport Master Plan	$1,000,000	$900,000		$60,000		$40,000	
	TOTAL	$2,511,000	$1,035,000	$0	$1,236,000	$0	$46,000	$194,000
	End of Year Airport Entitlement Balance:		$1,126,768	Carryover to next year				
		Starting Entitlement Balance:	$3,425,396	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2022	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Expand Commercial Service Apron (square off corners)	$708,200	$637,380	$0	$42,492		$28,328	
	Construct Rental Car Storage Lot (Phase II)	$570,000						$570,000
	SDARNG Readiness Center	$20,000,000						$20,000,000
	Rehabiltate Hangar Taxilanes	$150,000	$135,000	$0	$9,000		$6,000	
	SRE Equipment Replacement	$600,000	$540,000	$0	$36,000		$24,000	
	TOTAL	$22,028,200	$1,312,380	$0	$87,492	$0	$58,328	$20,570,000
	End of Year Airport Entitlement Balance:		$2,113,016	Carryover to next year				
		Starting Entitlement Balance:	$4,433,536	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2023	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Expand North Apron Area	$1,017,000	$915,300		$61,020		$40,680	
	Runway 14-32 Rehabilitation, Runway 32 Blast Pad & 25' Paved Shoulders	$7,560,000	$804,000	$6,000,000	$453,600		$302,400	
	Replace ATCT	$3,513,000	$2,500,000		$1,013,000			
	TOTAL	$12,090,000	$4,219,300	$6,000,000	$1,527,620	$0	$343,080	$0
	End of Year Airport Entitlement Balance:		$214,236	Carryover to next year				

Table 6-6 – Capital Improvement Plan (cont.)

		Starting Entitlement Balance:	$2,556,927	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2024	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Construct South Large Hangar Apron Area	$872,300	$785,070	$0	$52,338		$34,892	
	Construct 10-Unit T-hangar (1 Bldg) [Middle]	$701,300				$701,300		
	Replace SRE/Maintenance Facility	$9,500,000	$8,550,000	$0	$570,000		$380,000	
	Wildlife Hazard Assessment	$150,000	$135,000		$9,000		$6,000	
	TOTAL	$11,223,600	$9,470,070	$0	$631,338	$701,300	$420,892	$0
	End of Year Airport Entitlement Balance:		-$6,913,143	Carryover to next year				
	MID-TERM TOTAL:	$51,951,000	$18,700,750	$6,000,000	$3,660,050	$1,002,500	$986,700	$21,601,000
LONG-TERM PROJECTS (2025-2033)								
		Starting Entitlement Balance:	-$4,547,951	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2025	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Construct USFS Phase 2 (apron and roads in north SEAT area)	$178,000						$178,000
	Construct Conventional Hangars (3 Bldgs) [Main & South]	$1,835,000						$1,835,000
	Non-Aeronautical Office Site Prep	$165,000			$165,000			
	SRE Equipment Replacement	$600,000	$540,000	$0	$36,000		$24,000	
	TOTAL	$2,178,000	$0	$0	$165,000	$0	$0	$2,013,000
	End of Year Airport Entitlement Balance:		-$4,547,951	Carryover to next year				
		Starting Entitlement Balance:	-$2,160,001	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2026	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Non-Aeronautical Office	$1,500,000			$1,500,000			
	ARFF Equipment Replacement	$900,000	$810,000	$0	$54,000		$36,000	
	TOTAL	$2,400,000	$810,000	$0	$1,554,000	$0	$36,000	$0
	End of Year Airport Entitlement Balance:		-$2,970,001	Carryover to next year				

Table 6-6 – Capital Improvement Plan (cont.)

		Starting Entitlement Balance:	-$559,088	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2027	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Renovate Office for CBP Facility	$339,000			$339,000			
	TOTAL	$339,000	$0	$0	$339,000	$0	$0	$0
		End of Year Airport Entitlement Balance:	-$559,088	Carryover to next year				
		Starting Entitlement Balance:	$1,875,205	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2028	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Taxiway A Rehabilitation	$600,000	$540,000	$0	$36,000		$24,000	
	Construct 8-Unit Executive T-Hangar (1 Bldg) [Middle]	$1,258,000						$1,258,000
	SRE Equipment Replacement	$600,000	$540,000	$0	$36,000		$24,000	
	TOTAL	$2,458,000	$1,080,000	$0	$72,000	$0	$48,000	$1,258,000
		End of Year Airport Entitlement Balance:	$795,205	Carryover to next year				
		Starting Entitlement Balance:	$3,252,987	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2029	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Runway 5-23 Rehabilitation	$150,000	$135,000	$0	$9,000		$6,000	
	USFS Phase 3 (3rd loading position)	$1,000,000						$1,000,000
	Construct 10-Unit T-Hangar (1 Bldg) [Middle]	$701,300				$701,300		
	TOTAL	$1,851,300	$135,000	$0	$9,000	$701,300	$6,000	$1,000,000
		End of Year Airport Entitlement Balance:	$3,117,987	Carryover to next year				
		Starting Entitlement Balance:	$5,599,550	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2030	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Expand Deicing Apron (2 aircraft positions)	$2,000,000	$1,800,000	$0	$120,000		$80,000	
	SRE Equipment Replacement	$600,000	$540,000	$0	$36,000		$24,000	
	TOTAL	$2,600,000	$2,340,000	$0	$156,000	$0	$104,000	$0
		End of Year Airport Entitlement Balance:	$3,259,550	Carryover to next year				

Table 6-6 – Capital Improvement Plan (cont.)

	Starting Entitlement Balance:		$5,765,273	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2031	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Construct Conventional Hangars (3 Bldgs) [Main & South]	$2,580,000						$2,580,000
	TOTAL	$2,580,000	$0	$0	$0	$0	$0	$2,580,000
	End of Year Airport Entitlement Balance:		$5,765,273	Carryover to next year				
	Starting Entitlement Balance:		$8,295,375	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2032	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	ARFF Equipment Replacement	$900,000	$810,000	$0	$54,000		$36,000	
	TOTAL	$900,000	$810,000	$0	$54,000	$0	$36,000	$0
	End of Year Airport Entitlement Balance:		$7,485,375	Carryover to next year				
	Starting Entitlement Balance:		$10,040,124	FUNDING SOURCES				
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
2033	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Runway 14-32 Rehabilitation	$1,500,000	$1,350,000	$0	$90,000		$60,000	
	TOTAL	$1,500,000	$1,350,000	$0	$90,000	$0	$60,000	$0
	End of Year Airport Entitlement Balance:		$8,690,124	Carryover to next year				
	LONG-TERM TOTAL:	$16,806,300	$6,525,000	$0	$2,439,000	$701,300	$290,000	$6,851,000

Table 6-6 – Capital Improvement Plan (cont.)

ULTIMATE PROJECTS (AFTER 2033)								
YEAR	PROJECT	ESTIMATED	ESTIMATED FAA	ESTIMATED FAA	LOCAL--AIRPORT	LOCAL--DEMAND	STATE	OTHER
ULT	TITLE	TOTAL COST	ENTITLEMENT	DISCRETIONARY		SMALL HANGARS		
			90%		6%		4%	
	Construct East Parallel Taxiway	$21,435,500	$19,291,950	$0	$1,286,130		$857,420	
	Construct East Apron Area	$3,023,300	$2,720,970	$0	$181,398		$120,932	
			$0	$0	$0		$0	
	Construct 3-Unit T-Hangars (3 Bldgs) [Middle]	$738,600				$738,600		
	Construct Exec Box Hangars (10 units in 3 Bldgs) [Middle]	$1,996,000						$1,996,000
	Construct Conventional Hangars (5 Bldgs) [East]	$3,156,000						$3,156,000
	Construct 10-Unit T-Hangars (3 Bldgs) [East]	$2,032,200				$2,032,200		
	Construct Small Box Hangars (8 Bldgs) [East]	$1,288,000						$1,288,000
	Construct East Side Roads & Parking	$862,000	$775,800	$0	$51,720		$34,480	
	Construct East Side Taxiway Connectors	$129,000	$116,100	$0	$7,740		$5,160	
	Construct Small Hangar/T-Hangar Taxilanes/Taxiways/Apron	$750,200	$675,180	$0	$45,012		$30,008	
	Construct East Side Utilities (Water, Sewer Connection, Electricity, Natural Gas)	$1,807,700						$1,807,700
	ULTIMATE TOTAL:	$37,218,500	$23,580,000	$0	$1,572,000	$2,770,800	$1,048,000	$8,247,700
	GRAND TOTAL:	$137,547,230	$60,909,207	$8,244,550	$13,532,484	$5,760,300	$2,962,389	$46,138,300