CHAPTER THREE REQUIREMENTS

ED CARLSON MEMORIAL FIELD-SOUTH LEWIS COUNTY AIRPORT MASTER PLAN UPDATE

This chapter translates the aviation demand forecasts for the 20-year planning period into facility improvements by assessing the adequacy of the existing facilities in meeting the forecast demand. This chapter also reviews and analyzes facility compliance with FAA standards and recommendations. Any deviations from the standards will be documented and analyzed.

Improvements or new facilities are identified for the near- (2017), mid- (2022), and long-term (2032) timeframes, which align with the forecast timeframes. It's important to note that future improvements are tied to aviation demand and not timeframes since airport development should be demand-driven.

Table 3A provides a review of the projected aircraft operations and Airport Reference Code (ARC) by forecast timeframe.

Table 3A. Planning Activity Levels

	Near-term 2017	Mid-term 2022	Long-term 2032
Number of operations	17,001	17,772	19,426
ARC	B-I	B-II	B-II

Source: Chapter 2, Forecasts

This chapter will also review and analyze facility compliance with FAA standards and recommendations. Any deviations from the standards will be documented and analyzed. Requirements identified in this chapter will provide the framework for identifying possible long-term development concepts for the Airport in the next chapter.

PLANNING CRITERIA

The development and use of planning criteria ensures that recommended improvements align with the goals and objectives of the air transportation system, appropriate aviation industry segments, and the airport sponsor's vision. The sources from which the planning criteria are drawn include:

- Federal Aviation Administration (FAA) – FAA design guidelines found in AC 150/5300-13A Airport Design provide the planning criteria, with respect to the current as well as future critical or design aircraft, for the runway, taxiways and apron areas.

- Transportation Security Administration (TSA) – Although TSA does not regulate general aviation airports like South Lewis County Airport, they do provide guidance for security at general aviation airports. The guidelines provided by the TSA are tailored to an airport's size and risk level.

- Washington State Aviation System Plan (including the Washington State Long-Term Air Transportation Study) - Provides a distribution of airports by classification as well as recommendations and direction on how to meet the state's long term commercial and general aviation needs.

- Business Aviation Industry – The National Business Aviation Association (NBAA) represents the industry and provides recommendations for airports' facilities and services to accommodate business aviation needs.

- Lewis County and Airport Users – Planning Advisory Committee members, other meeting participants and survey respondents provided input specific to Ed Carlson Memorial Field – South Lewis County Airport. The local airport community is an important source since its operational issues, community relationships, and future vision for the airport help shape the list of future facility needs.

- The Airport Business Plan (2010) - Developed by Lewis County, the plan provides a needs assessment as well as a list of short-term and long-term goals.

AIRPORT ROLE

Understanding an airport's role in the national, state and regional aviation systems is an important component in developing the planning criteria.

The National Plan of Integrated Airport Systems (2013-2017) classifies the South Lewis County Airport (TDO) as a general aviation facility. Further, FAA's General Aviation Airports: A National Asset, published in May 2012, divided the general aviation airports into four categories based on existing activity measures (2009 data) such as the number and types of based aircraft (i.e., aircraft that are stored at an airport), as well as the volume and types of flights. The four categories are national, regional, local, and basic. The document classifies TDO as a Local airport. A local airport is defined as one that "supplements local communities by providing access primarily to intrastate and some interstate markets."

The Washington State Aviation System Plan (WASP) and the Washington State Long-Term Air Transportation Study (LATS) classify TDO as a Community Service Airport. Community service airports are classified as such after meeting the following threshold criteria:

- 20 or more based aircraft
- Paved runway

According to WASP, "Community Service Airports serve small to medium-sized communities and are busy enough to warrant aviation support services such as fuel sales." Typically, Community Service Airports are owned by a public entity and have 30-minute (driving time) service area coverage.

The WASP designates a role for each airport within the system, helping to distinguish between the various levels of service and activities associated with each airport across the state. WASP defined six different roles or classifications for the 138[1] airports considered in the statewide system. These six classifications are:

- Commercial Service – 16
- Community Service – 23
- Rural Essential – 38
- Regional Service – 19
- Local Service – 33
- Seaplane Bases – 9

WASP recommends a set of performance objectives for the statewide airports. These objectives are divided into five categories: Operational Factors, Planning, Land Use Compatibility Protection, Facilities and Services. The objectives for Operational Factors, Planning, and Land Use Compatibility Protection are the same (where applicable) regardless of the airport's classification. The performance objectives for Facilities and Services are dependent on the airport's classification.

Table 3B provides a comparison between the WASP performance objectives for Community Service Airports and the existing conditions at TDO. The table focuses on the two categories of Facilities and Services.

As noted in the table, the Airport meets or exceeds most of the community service airport performance objectives.

The airport does not have a weather reporting station. There is, however, a station 14 miles away at Chehalis Airport that pilots use to obtain weather conditions.

[1] This number is currently lower due to recent airport closures.

Table 3B: WASP Performance Objectives and Existing Conditions

Facility/Service	Performance Objective	TDO Existing	
Runway Length	3,200 feet	4,479 feet	✓
Taxiway	Parallel	Parallel	✓
Instrument Approach	1 mile visibility minimum	RNAV GPS – 1 mile visibility minimum	✓
Lighting	Medium Intensity	MIRL and REIL	✓
Visual Glide Slope Indicators	Must be Provided	VASI on RWY 6 PAPI on RWY 24	✓
Weather Reporting	Super-Unicom	--	
Fuel Sales	100LL	100LL	✓
Maintenance Service	Minor	Minor	✓

Source: WASP, 2009; Chapter 1, Inventory. Performance Objectives for Community Service Airports

AIRSIDE DEMAND/CAPACITY ANALYSIS

As indicated in Chapter Two, Forecasts, the airport is expected to serve more than 19,400 operations annually by 2032. Assessing the current capacity of the airfield is important to identify whether there are any improvements needed to accommodate the forecast demand.

The capacity analysis is based on FAA AC 150/5060-5, Airport Capacity and Delay. Additionally, ACRP Report 79 published by the Transportation Research Board (TRB) in 2012 provides a Prototype Airfield Capacity Spreadsheet Model that is "built on base calculations following the theory in the FAA Airfield Capacity Model (ACM) and applies variable separation, spacing and clearance standards following the guidelines included in FAA JO 7110.65, Air Traffic Control, and FAA EM-78-8A, Parameters of Future ATC Systems Relating to Airport Capacity/Delay." The spreadsheet model provided by the TRB was used to calculate the airfield capacity at TDO.

There are two measures of capacity that have been used in airport planning, they are:

- **Hourly capacity:** considers the throughput during a typical busy hour. Factors such as percentage of arrivals, runway crossings, and taxiway exit locations are considered to arrive at an hourly number of aircraft that can use the airfield without undue delays.

- **Annual Service Volume (ASV):** is an estimate of the number of aircraft operations that can be accommodated in one year. This measure is used to program additional runways, and/or modified taxiway exits.

Airfield capacity improvements should generally be planned and programmed when the airport reaches 60% of its capacity. Construction of these improvements should begin before or upon the reaching 80% of its capacity.

In calculating the Airport's ASV, the projections of annual operations by the fleet mix specified in Chapter Two were used. The analysis considered various factors including airfield layout, meteorological conditions, runway conditions, runway use, aircraft mix, percent arrivals, percent touch-and-go's, and exit taxiway locations. The demand characteristics that are relevant to calculating airfield capacity are the mix of aircraft types that utilize the airport in the design hour along with the percentage of arrivals and the percentage of touch-and-go operations as well as the percentage of IFR operations. Aircraft types are classified according to size as shown below.

- **Class A:** Small single engine aircraft weighing less than 12,500 pounds
- **Class B:** Small twin engine aircraft weighing less than 12,500 pounds
- **Class C:** Aircraft weighing between 12,500 pounds and 300,000 pounds
- **Class D:** Aircraft weighing more than 300,000 pounds

The Annual Service Volume for TDO was calculated at 213,000 operations. With operations forecast to reach 19,426 by 2032, the Airport will only reach nine percent of its capacity within the 20-year planning period.

AIRSIDE DESIGN STANDARDS

FAA design standards listed in AC 150/5300-13A, *Airport Design*, guide the planning and development of airside facilities at an airport. This section provides a brief description of some of these design standards contained in AC 150/5300-13A, and identifies the conditions unique to the South Lewis County Airport that influence design recommendations.

The FAA is responsible for the overall safety of civil aviation in the United States and all of the design standards in AC 150/5300-13A are primarily driven by safety. Other factors that influence the design standards included in the AC are efficiency and utility.

The changes that affect the safety and efficiency of aviation are constantly evolving as the aviation industry continues its rapid development. AC 150/5300-13A (dated September 2012), replaced and cancelled AC 150/5300-13, *Airport Design*, which was originally published in 1989,

with changes through 2012. AC 150/5300-13A includes various clarifications and introduces new terms and concepts. This section will provide a brief summary of some of these new concepts and discuss their application to TDO.

DESIGN AIRCRAFT AND RUNWAY DESIGN CODE

The planning and design of airfield facilities is primarily based on the types of aircraft using or forecast to use the airport. The design aircraft is the most demanding aircraft operating or forecast to operate at that facility on a "regular basis", which the FAA defines as an aircraft with more than 500 or more itinerant operations annually. Characteristics of the design aircraft, such as approach speed, wingspan, tail height, main gear width, cockpit to main gear length, aircraft weight, and takeoff and landing distances influence the dimensions of airfield facilities and protected surfaces. **Table 3C** shows the various aircraft characteristics and the related design components that they influence. It is important to note that the design aircraft may be a specific aircraft type, or a composite of aircraft characteristics.

Table 3C. Aircraft Characteristics and Design Components

Aircraft Characteristics	*Design Components*
Approach Speed	RSA, ROFA, RPZ, runway width, runway-to-taxiway separation, runway-to-fixed object
Landing and Takeoff Distance	Runway Length
Cockpit to Main Gear Length (CMG)	Fillet design, apron area, parking layout
Outer to Outer Main Gear Width (MGW)	Taxiway width, fillet design
Wingspan/Tail Height	Taxiway and apron OFA, parking configuration, hangar locations, taxiway-to-taxiway separation, runway to taxiway separation

Source: FAA AC 150/5300-13A

The Airport Reference Code (ARC), also presented at the end of Chapter Two, Forecasts, represents the airport's highest Runway Design Code (RDC) for planning and design purposes. The Runway Design Code (RDC) is based on planned development and signifies the design standards to which the runway is to be built. The RDC is composed of three components, the Aircraft Approach Category (AAC), the Airplane Design Group (ADG) and the visibility minimums.

The first component, AAC, is depicted by a letter (A through E) and relates to the approach speed of the design aircraft. The second component, ADG, is depicted by a Roman numeral (I through VI) and relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to runway visibility minimums as expressed in Runway Visual Range (RVR) equipment measurements. RVR-derived values represent feet of forward visibility that have statute mile equivalents (e.g. 2400 RVR = ½-mile). For runways that are designed for visual approach use only, this component would read "VIS."

Table 3D summarizes the Runway Design Code (RDC) classifications, which is similar to the ARC discussion in Chapter Two. This information is essential in understanding the airside requirements and what drives the airside component of the development alternatives in the next chapter.

Table 3D. Runway Design Code Classifications

Aircraft Approach Category (AAC)	
AAC	Approach Speed
A	Less than 91 knots
B	91 knots to 120 knots
C	121 knots to 140 knots
D	141 knots to 165 knots
E	Approach speed 166 knots or more

Airplane Design Group (ADG)		
Group #	Tail Height (ft)	Wingspan (ft)
I	< 20'	< 49'
II	20' to < 30'	49' to < 79'
III	30' to < 45'	79' to < 118'
IV	45' to < 60'	118' to < 171'
V	60' to < 66'	171' to < 214'
VI	66' to < 80'	214' to < 262'

Approach Visibility Minimums	
RVR (ft)	**Flight Visibility Category (statue mile)**
4000	Lower than 1 mile but not lower than ¾ mile (APV ¾ but< 1 mile)
2400	Lower than ¾ mile but not lower than ½ mile (CAT-I PA)
1600	Lower than ½ mile but not lower than ¼ mile (CAT-II PA)
1200	Lower than ¼ mile (CAT-III PA)

Source: FAA AC 150/5300-13A

TAXIWAY DESIGN GROUP

Under former guidance, taxiway design was based on Airplane Design Group (ADG). In the updated AC 150/5300-13A, taxiway design is based on a newly established Taxiway Design Group (TDG), which is based on the overall Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) distance. There are seven (1 through 7) TDG classifications. With respect to TDO, all taxiway lateral clearances should be planned for TDG 2 lateral clearances on the Airport Layout Plan.

DESIGN STANDARDS FOR SOUTH LEWIS COUNTY AIRPORT

The most demanding aircraft currently operating at the Airport on a "regular" basis belong to the B-I family. It is expected that operations by B-II aircraft will surpass the 500 annual operations threshold by 2022, or the mid-term of the planning window.

There are two instrument approach procedures published for the Airport, RNAV (GPS) Runway 6 and RNAV (GPS) Runway 24. These approaches require Navigation using Global Positioning System satellites and provide visibility minimums as low as one mile for Category A and B aircraft. It should be noted that many of the smaller aircraft using the airport are not equipped to use these approaches and rely on Visual Approach Procedures. Based on the above description, TDO currently has an RDC of B-I. This RDC is forecast to change to B-II by 2022. The FAA has also introduced the Runway Reference Code (RRC) which is comprised of the same three components as the RDC; however, RRC describes the current operational capabilities of a runway where no special operating procedures are necessary. The current RRC is B-I. The RRC is forecast to change to B-II by 2022. Requirements for both RRC classifications will be discussed throughout this chapter. As previously mentioned, taxiway standards will be determined based on the current and forecast classification of TDG 2.

RUNWAY REQUIREMENTS

NUMBER AND ORIENTATION OF RUNWAYS

The number of runways on a field is typically driven by activity levels and/or wind coverage. Busy airports often provide parallel runways to accommodate their high activity levels while minimizing delay. The South Lewis County Airport's low activity levels are easily accommodated by a single runway.

FAA design standards recommend additional runway orientations when the primary runway orientation provides less than 95 percent wind coverage. This section will analyze the orientation of Runway 6-24. FAA has established crosswind limits of 10.5 knots for general aviation A-I and B-I aircraft, 13 knots for A-II and B-II general aviation aircraft and 16 knots for transport aircraft A-III, B-III and C-I through D-III. Aircraft in approach category IV (A-IV through D-VI) have a crosswind limit of 20 knots.

Wind data for the period of 1990-1999 was obtained from the National Climatic Data Center (NCDC) and used in the wind rose analysis for TDO. The results of the wind analysis are provided in **Table 3F**.

Table 3F. All Weather Wind Coverage Analysis

Crosswind Component	10.5 knots	13 knots	16 knots
Wind Coverage	95.71%	97.54%	99.36%

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center, Station 72683 Scappoose, Oregon. Period of Record: Jan 2001-Dec 2009

Based on this all-weather wind analysis for TDO, the existing single-runway configuration provides acceptable wind coverage (i.e., in excess of 95.71%) for each of the crosswind components (10.5 knots, 13 knots and 16.5 knots).

RUNWAY LENGTH

Runway 6-24 is the Airport's only runway. It has an effective length of 4,479 feet, which is less than its previous 5,000-foot length before relocated thresholds were established to comply with FAA design standards for obstacle clearance slope and runway safety area.

As previously stated, the Airport is classified by the Washington Aviation System Plan (WASP) as a Community Service Airport for which the objective runway length is 3,200 feet. However, this length is a recommended minimum length for system planning. Runway length requirements for master planning purposes are based on existing and forecast airport user needs and the County's long-term vision.

FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, specifies the use of the 5-Step procedure for determining runway length requirements for purposes of airport design.

It is important to note that, for small aircraft with a maximum takeoff weights (MTOW) of 12,500 pounds or less and larger aircraft with an MTOW of more than 12,500 pounds (up to and including 60,000 pounds), the use of the runway length curves specified by AC 150/5325-4B

generates runway lengths equivalent to those generated using the FAA Airport Design Computer Program. The runway length requirements are influenced by various variable that include the airport's elevation (374 feet), the effective runway gradient (0.41%) and the Mean Maximum Temperature of the hottest month (78.9 Degrees F).

The analysis shows that the existing effective runway length of 4,479 feet is sufficient to serve small airplanes (less than 12,500 lbs.); these are the primary users of the runway today. The existing runway length is not sufficient to serve large airplanes (more than 12,500 lbs. but less than 60,000 lbs.) even when these airplanes are at 60 percent of their useful load. For large airplanes to use the runway, they must take a weight penalty of around 50% of their useful load. **Table 3G** illustrates the results of the runway length analysis.

Table 3G. FAA Runway Lengths

Airport elevation	374 feet
Mean daily maximum temperature of the hottest month	78.80 F.
Maximum difference in runway centerline elevation	20 feet
Length of haul for airplanes of more than 60,000 pounds	500 miles
Dry runways	
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with approach speeds of less than 30 knots	310 feet
Small airplanes with approach speeds of less than 50 knots	830 feet
Small airplanes with less than 10 passenger seats	
75 percent of these small airplanes	2510 feet
95 percent of these small airplanes	3040 feet
100 percent of these small airplanes	3630 feet
Small airplanes with 10 or more passenger seats	4140 feet
Large airplanes of 60,000 pounds or less	
75 percent of these large airplanes at 60 percent useful load	4830 feet
75 percent of these large airplanes at 90 percent useful load	6200 feet
100 percent of these large airplanes at 60 percent useful load	5320 feet
100 percent of these large airplanes at 90 percent useful load	7730 feet
Airplanes of more than 60,000 pounds	Approximately 5140 feet

Source: Chapter 2 of AC 150/5325-4A, Runway Length Requirements

The Airport is projected to upgrade to a B-II facility by 2022, so operations by large aircraft are anticipated to increase. While the King Air—a small aircraft (weighing 12,500 lbs. or less)—is projected to be the future critical aircraft, the County should consider protecting for a longer runway up to 6,200 feet beyond the 20-year planning period.

RUNWAY WIDTH

B-I runways with visibility minimums not lower than ¾ mile require a width of 60 feet. The requirement increases to 100 feet for visibility minimums lower than ¾ mile.

B-II runways with visibility minimums not lower than ¾ mile require a width of 75 feet. The requirement increases to 100 feet for visibility minimums lower than ¾ mile.

Runway 6-24's current width of 150 feet exceeds the requirements for B-I and B-II runways. When the runway was rehabilitated in 2003, the FAA funded the 75-foot width for a B-II runway and the County funded the 37.5 feet on either side. The additional runway width translates to added maintenance costs, but the County prefers the wider runway for enhanced operational safety during crosswinds.

RUNWAY PAVEMENT

Runway 6-24 has a pavement strength rating of 25,000 pounds Single Wheel Loading (SWL) with no Dual Wheel Loading (DWL) strength rating. The last runway pavement maintenance project took place in 2012 when cracks were sealed. The runway pavement appears to be in good condition.

A recent pavement inspection was completed by Washington State Department of Transportation (WSDOT) in August of 2012. The inspection provided PCI values for the various pavement sections on the airfield. PCI value is a numerical rating of the pavement condition that ranges from 0 to 100, with 0 being the worst possible condition and 100 being the best possible condition.

The inspection found that TDO's runway pavement has a PCI rating of 85 and the runway shoulders have a PCI of 94. WASP 2009 recommends that runway pavements at all airports in the State have a PCI of 75. The plan also recommends a PCI of 70 for taxiways and aprons.

Based on the inspection results, the runway pavement is considered to be in good to fair condition. The continuous maintenance of the pavement is necessary to ensure its operational safety and reduce costs by delaying costly runway repaving projects. Additionally, the decision

as to whether to decrease the width of the runway will influence the timing of any future runway re-pavement project. Maintenance work such as crack seal, fog seal is recommended in five to eight years. Pavement beyond the 75-foot center of the runway is not eligible for FAA funding, since 75 feet is the FAA design standard applied to the TDO runway.

Pavement strength required for the planning period is a minimum of 12,500 pounds SWL, but increased operations are anticipated by large aircraft through 2032 and beyond.

TAXIWAYS REQUIREMENTS

TAXIWAYS WIDTH

Under former guidance, taxiway design was based on Airplane Design Groups (ADG). In the updated Advisory Circular AC 150/5300-13A, taxiway design is based on newly established Taxiway Design Group (TDG), which is based on the overall Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) distance.

The South Lewis County Airport's taxiway system consists of a full-length parallel taxiway, designated as Taxiway A, with a 272-foot runway to taxiway centerline separation. There are four connecting taxiways between the runway and Taxiway A designated as A1, A2, A3 and A4 from west to east. Connecting taxiways A1 and A4 are located at Runway 6 and Runway 24 ends, respectively; A2 is at the east end of the building area and A3 is just east of midfield.

Parallel Taxiway A is 21 feet wide between connecting Taxiways A2 and A4, but 50 feet wide between A1 and A2, which is the westernmost 1,000-footstretch of taxiway in front of the building area. Taxilanes off this portion of Taxiway A serve the aircraft hangar areas. Since TDG 2 requires a 35-foot wide taxiway, more than 3500 feet of Taxiway A requires widening.

Additionally, the airport has plans to develop a 14-acre area south of the runway. Development of this area would require the construction of a taxiway system to serve the development area. Some environmental studies and initial permitting efforts have been conducted for the development of a new parallel taxiway to serve the 14-acre parcel. The development south of the runway will provide additional hangar space as well as tiedown positions, allowing for the relocation of the aircraft tiedowns in the Runway Object Free Area.

It should be noted that taxiway improvements and the need for taxiway widening were commonly mentioned in the user survey responses.

TAXIWAY AND TAXILANE PAVEMENT

The pavement inspection completed by Washington State Department of Transportation (WSDOT) in August of 2012 provided PCI ratings for the various taxiways and taxilanes on the airfield. Table 3H provides a summary of the PCI scores for the various taxiways and taxilanes.

Table 3H. Taxiways/Taxilanes Pavement Ratings

Taxiway/Taxilane Pavement	PCI	Condition
Taxiway A1 & A2 (incl. 50' wide Taxiway A section)	31	Poor
Taxiway A (21' wide section), A3 & A4	11	Poor
Taxilanes between Hangars	7-32	Poor

Source: WSDOT Airport Pavement Management System Study, 2012

As could be seen from Table 3H, all taxiway and taxilane pavements are in poor condition and require near-term reconstruction.

Also, the taxilane at the far west side of the Airport has a gravel surface and should be asphalt-paved to reduce FOD on the adjacent taxiways.

TAXIWAY SEPARATIONS AND INTERSECTIONS

The required runway to taxiway separation distance for B-I and B-II runways with visibility minimums not lower than ¾ mile is 225 feet and 240 feet, respectively. Therefore, the Airport's current runway to taxiway separation complies with FAA design standards for the planning period.

The taxiway and taxilane object free areas are based on the ADG of the most critical aircraft using the taxiway/taxilane. For an ADG of I, the taxiway object free area is 89 feet and the taxilane object free area is 79 feet. For ADG II, the taxiway object free area is 131 feet and the taxilane object free area is 115 feet. Existing and future taxiways/taxilanes should ensure these surfaces remain clear. According to the current ALP prepared during the last planning effort, there are hangars in portions of the taxilane object free area.

For enhanced safety, connecting taxiways should intersect runways at 90 degrees. Runway incursions are reduced with taxiways perpendicular to runways since this alignment increases pilot awareness of the runway intersection, markings, and signage. FAA AC 150/5300-13A, (Sep 2012) emphasizes the critical importance of 90-degree taxiway connections to the runway for safety purposes. Further, this guidance indicates that taxiways from the apron to the airfield should not provide direct access to the runway. In other words, the connecting taxiways should

require the pilot to make turns prior to runway access to increase pilot awareness of the active runway. Consequently, the County should plan all future taxiway connectors and consider realignment of others to comply with this new guidance.

OTHER AIRFIELD DESIGN STANDARDS

This section examines several additional design standards that are outlined by the FAA and should be considered in the planning and design of airports. **Table 3I** provides a summary of the FAA design standards that are related to the current and forecast RDC for TDO. The table also presents the existing dimensions at TDO. As previously mentioned, the current RDC at TDO is B-I and it is expected that the RDC will be upgraded to B-II around 2022.

Table 3I. Design Standards Matrix

	Existing Runway 6-24	B-I and Visibility not lower than 1 mi	B-II and Visibility not lower than 1 mi
Other Runway Requirements			
Runway Width	**150 feet**	**60 feet**	75 feet
Runway Safety Area			
Width	150	**120**	150
Length beyond Runway End	300	240	300
Runway Object Free Area			
Width	400*	**250**	400
Length Beyond Runway End	200	**200**	200
Runway Obstacle Free Zone			
Width	400	**250**	400
Length beyond Runway End	200	**200**	200
Runway to Parallel Taxiway Centerline	272	**225**	240
Runway Centerline to Parking Hold line	200	**200**	200
Other Taxiway Requirements			
Taxiway Width	**Varies, 21+ feet**	**Based on TDG 35 feet for TDG 2**	Based on TDG **35 feet for TDG 2**
Taxiway Object Free Area Width	131*	**89**	131
Taxiway Safety Free Area Width	79*	49	79
Taxiway Centerline to Fixed or Movable Object	65.5*	**44.5**	65.5

*Source: AC 150/5300-13A. *Aircraft using turf area between the taxiway runway for overflow parking may be inside the Taxiway Object Free Area, Taxiway Safety Area, or Runway OFA.*

Runway Safety Area (RSA): The identification of the existing as well as the future RSA at an airport is important in order to ensure that it is located on airport property and is properly

cleared and graded to meet FAA standards. The Runway Safety Area is a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. The RSA should be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations. The RSA dimensions associated with B-II standards and visibility minimums not lower than one mile are a width of 150 feet extending the full length of the runway plus 300 feet beyond the runway ends. The airport does meet these requirements. Changing Instrument Approach Visibility to less than ¾ mile would increase the RSA requirements.

Runway Object Free Area (ROFA): Like the RSA, the ROFA is centered on the runway centerline, extends beyond the runway ends, and is determined by the aircraft type and approach visibility minimums. The OFA is the same length as the RSA (runway length plus 300 feet on each runway end) but is wider (500 feet). The OFA must remain clear of objects at the RSA elevation, but it does not have a grading requirement. However, aircraft have parked on the turf south of the apron and Taxiway A, which is inside the ROFA. The ROFA should remain clear. It's important to note that changing Instrument Approach Visibility to less than ¾ mile would increase the ROFA requirements.

Runway Obstacle Free Zone: The runway OFZ is a defined volume of airspace centered above the runway centerline. It is the airspace above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The standard OFZ for RDC B-II aircraft is 400 feet wide and 200 feet beyond the runway end. The OFZ must remain clear of objects other than frangible NAVAIDs. Runway 6-24 OFZ surface is clear of objects.

Runway Protection Zone: The purpose of the RPZ is enhancing the protection of people and property on the ground. The RPZ is a trapezoidal area centered about the extended runway centerline and beginning 200 feet from the runway end. Lewis County should have full control of the RPZ through fee simple ownership and/or easements. All objects should be clear of the RPZ but limited uses are permitted. There are currently two roads in the RPZ on the west end – Buckley Road and Jackson Highway. Development alternatives in the next chapter should address the roads in the RPZ. The County does not own the entire RPZ, so the County should acquire avigation easements for these portions of the RPZ.

Inner Approach OFZ: For runways with an approach lighting system, an Inner-approach OFZ is required. The Inner-approach OFZ is airspace centered on the approach area at the same width as the Runway OFZ, beginning at 200 feet from the runway end, and extending at a 50:1 slope out 200 feet past the light unit in the approach lighting system. An Inner-transitional Approach OFZ is only required for precision instrument approach runways with less than ¾-mile visibility

and is located along the sides of the Runway OFZ and Inner-approach OFZ. An Inner-transitional Approach OFZ is not required at TDO.

Surface Gradient: The maximum allowable longitudinal grade on the existing runways is 2.0%, which is associated with Aircraft Approach Category A and B. The runway has a percent gradient of 0.41% which is well below the acceptable 2.0%.

HELICOPTER OPERATIONS

There is no officially designated helipad or heliport on the airfield so helicopters may arrive on the runway approach and hover-taxi to park on the apron or refuel. Based on the forecasts in Chapter 2, the number of helicopter operations is currently at 651 annual operations and is expected to reach 778 operations by 2032. Based on the current and forecast helicopter activity, a helipad is not required. However, as fixed wing and rotorcraft operations grow, the County may want to consider designating a separate area for helicopter parking.

NAVIGATIONAL AIDS AND WEATHER REPORTING

The airport's navigational aids include visual and instrument approach aids.

The visual aids include a rotating beacon that sits atop a 60-foot tower at the far west end of the building area, a Visual Approach Slope Indicator (VASI) on Runway 6, a Precision Approach Path Indicator (PAPI) on Runway 24 and two wind indicators located at the runway ends north of the airfield. The wind indicator near Runway 6 end is lighted allowing for its night time operation. The existing VASI system on Runway 6 is past its useful life and should be replaced with a new PAPI system, which is also less costly to maintain and operate.

Instrument approaches are either precision or non-precision approaches. Precision instrument approach aids provide an exact alignment and decent path for an aircraft on final approach to a runway while non-precision instrument approach aids provide only runway alignment information.

The airport does not have any instrument approach equipment. However, there are two instrument approach procedures that are published for the Airport, RNAV (GPS) Runway 6 and RNAV (GPS) Runway (24). These approaches provide vertical guidance and runway alignment information with visibilities of 1 mile or less. As the Global Positioning System (GPS) technology continues to advance at a rapid pace, stand-alone instrument assisted approaches will eventually be established that provide vertical guidance down to visibility minimums currently associated with precision instrument runways.

Although the Airport manager stated that most of the aircraft using the airport today do not have the proper equipment to use GPS approaches, it is expected that in the near future most if not all aircraft will be equipped with such equipment. WASP recommends that Community Service Airports, such as TDO, provide Instrument Approaches with a 1 mile visibility minimum.

It is worth noting that a survey responder indicated that the provision of an ILS would be beneficial for the training operations at the airport.

AIRFIELD LIGHTING, MARKINGS AND SIGNAGE

The medium intensity runway lighting (MIRL) system and Runway End Identifier Lighting (REIL) system were installed in 2003. The MIRL system is in good operating condition, but with an estimated 20-year life cycle for the electrical system, the MIRL system replacement should be planned for in 2023. The County should consider replacing the lighting with a new LED lighting system, which will use less power and a longer life span.

Runway 6-24 markings comply with FAA Advisory Circular (AC) 150/5340-1J, Standards for Airport Markings. Taxiway and apron areas also require marking and do not comply with the recommendations of the FAA. These markings should be provided as part of the taxiway widening project.

Taxiway lighting provides for enhanced ground movement at night. The parallel taxiway does have non-standard reflectors – each pair of reflectors is staggered opposite each other along the taxiway. A Medium Intensity Taxiway Lighting (MITL) is recommended for the taxiway once it is widened.

WEATHER REPORTING SYSTEMS

The airport does not have a weather reporting system on site. There is an Automated Weather Observing System (AWOS) located 14 miles northwest at Chehalis-Centralia Airport that provides weather conditions with updates on an hourly basis or when weather conditions change significantly.

WASP 2009 recommends that Community Service airports be equipped with Super-Unicom. Further, multiple survey respondent indicated the need for weather reporting systems at the airport. It is recommended that the airport installs a Super-Unicom system.

LANDSIDE FACILITIES

The Airport's landside facilities are located on the north side of the airfield near the Runway 6 end. Landside facilities include the airport office, aircraft storage hangars, fuel storage, vehicle access and parking. The capacity of each of these areas was examined in relation with the projected demand to identify facility needs during the planning period.

AIRPORT OFFICE BUILDING

The Airport Business Plan developed in 2010 identified the replacement of the airport administration and pilot lounge facilities building as a short term goal. The plan also established attracting new airport related commercial development as a long term need. Enhanced pilot lounge facilities could help attract a Fixed Base Operator (FBO) to the airport.

The new airport office building is presently providing one airport administration/ management office and a lobby area. However, calculated airport administration space requirements are considered in the planning process and added to the GA terminal requirements provided below.

GA TERMINAL FACILITIES

The GA terminal space requirements include the space required for a pilot lounge, flight planning room, management, storage, vending machines and various other needs. The estimation of the terminal facilities needs is based on the number of airport users that are expected to use these facilities during the design hour. Industry practices are to provide 120 square feet per design hour itinerant passenger. The number of passengers is determined by multiplying design hour itinerant operations by the number of passengers per aircraft (occupancy factor). An increasing occupancy factor was used (1.2 in 2013 to 1.6 in 2032) to account for the current trend of larger, more sophisticated aircraft using the airport.

Table 3J illustrates the GA terminal area facilities requirements. Currently, the airport office building provides 728 square feet of space for a pilot lounge area and airport administrative office. The GA terminal needs could be served by a future FBO facility, a new centralized facility, or possibly a combination of FBO and airport office building area.

Table 3J. Terminal Area Facilities Requirements

	Current	Near-term (2017)	Mid-term (2022)	Long-term (2032)
Design Hour Operations	13	14	15	16
Design Hour Itinerant Operations (73% of total)	10	11	11	12
Occupancy Factor	1.2	1.3	1.4	1.6
Design Hour Itinerant Passengers	12	14	15	19
Required Space (s.f.)	1,440	1,680	1,800	2,280

Source: WHPacific

HANGAR REQUIREMENTS

Aircraft hangars at the Airport provide storage for based aircraft, but some are parked outside. With limited space available, transient aircraft are not typically stored in hangars, but must park in the grass. There are two County-owned hangars and others are private hangars on ground leases. Hangars at the Airport consist of both conventional/community hangars and T-hangars.

Hangar use is a function of the local climate conditions, security concerns, owner preferences and space availability. Lease prices are also a factor a determining factor. Currently, most of the aircraft at TDO are housed in hangars and this trend is expected to continue through the planning period due to climatic concerns as well as the general aviation trend of moving towards bigger, more expensive aircraft.

The hangar space analysis assumes that all based aircraft will use hangar space if and when the space is available. Additionally, the analysis assumes that 90 percent of based single engine aircraft will require T-hangar space with the remaining 10 percent in addition to 100 percent of multi-engine aircraft and helicopters will require conventional hangar space.

The space requirements were calculated based on industry practices of providing 1,250 square feet per based aircraft in T-Hangar, 1,500 square feet for single engine aircraft and 2,500 square feet for multi-engine aircraft in conventional hangars. Additionally, portions of conventional hangars are usually used for aircraft maintenance and servicing. Accordingly, a planning standard of 15 percent of the total hangar space needs was added to the required space. **Table 3K** illustrates the additional hangar space needs at the Airport for the planning period.

Table 3K. Hangar Storage Requirements

	Existing	*Near-Term*	*Mid-Term*	*Long-Term*
BASED AIRCRAFT				
Single Engine	36	37	38	40
Multi-engine	6	6	6	6
Jet	0	0	0	0
Helicopter	2	2	2	3
Other	3	3	4	4
HANGAR POSITIONS				
T-hangar	32	33	34	36
Conventional	15	15	16	17
Total	47	48	50	55
HANGAR AREA REQUIREMENTS (s.f.)				
T-hangar Area	40,000	41,250	42,500	45,000
Conventional Hangar Area	33,500	33,500	36,000	38,500
Maintenance Area	5,025	5,025	5,400	5,775
Total Area	**78,525**	**79,775**	**83,900**	**89,275**

Source: WHPacific

The existing hangar space at the Airport is fully utilized which means that an additional 10,750 square feet (difference between long term and current need) of hangar space would be required to accommodate the forecast increase in based aircraft.

AIRCRAFT APRON

As mentioned in Chapter 1, Inventory, the Airport has one contiguous apron area located at the west end of the airfield. This asphalt paved apron area is 420 long by 140 feet wide or 6,533 square yards. There are no tiedown anchors on the apron itself. According to the county, the apron area is used by two locally based aircraft in addition to transient aircraft.

There are three turf tiedowns just south of the airport office parking lot. Also, a set of 15 tiedowns located to the south of the apron provides parking for several based aircraft. However, County records indicate that these aircraft are not active. As indicated on the 2003 ALP, these tiedown positions need to be relocated since they are within the required ROFA. Therefore, they are not considered official tiedowns.

The apron area should provide sufficient space for the parking of transient aircraft as well as locally based aircraft that are not housed in hangars. This analysis assumes that the needed

hangar space will be provided in a timely manner to accommodate the demand. Failure to provide sufficient hangar space would increase the apron area requirements. For planning purposes, it is assumed that 15 percent of locally based aircraft will require space on the parking apron due to some aircraft requiring both hangar storage and parking apron space.

Transient apron space is determined by estimating the percentage of busy-day operations that will require tiedown space at a given time. A planning criterion of 360 square yards per based aircraft and 500 square yards per transient aircraft was used to determine the apron requirements. These dimensions take into the account the space needed for circulation, taxilane Object Free Areas (OFA) and wingtip clearances, but depend on layout and other ramp circulation needs. Consequently, the development alternatives should consider the apron area requirements as the minimum requirement with additional circulation, as needed, for varying layouts.

Table **3L** presents the apron space analysis for the planning period. As shown, the apron area is not adequate for the current demand. This is evident in the use of the grass area north of the runway for aircraft tiedowns. Additional apron space must be provided and tiedowns in the grass north of the airfield must be removed as they fall within the runway object free area.

Regular pavement maintenance for the apron is necessary. The apron was reconstructed back in 2008. Maintenance work such as crack seal, fog seal is recommended in the near-term and every five to eight years thereafter.

Table 3L. Apron Space Requirements

Operations	Existing	2017	2022	2032
Annual operations	16,265	17,001	17,772	19,426
Peak Month	2,765	2,890	3,021	3,302
Design Day (Average Day of Peak Month)	89	93	97	107
Itinerant Operations (73% of Design Day)	65	68	71	79
ITINERANT AIRCRAFT				
Itinerant Aircraft Landing	33	34	36	40
Aircraft Simultaneously Parked (50%)	17	17	18	20
BASED AIRCRAFT				
Total Based Aircraft	47	48	50	53
Based Aircraft Parking	7	8	8	8
REQUIRED POSITIONS				
Total Aircraft Parked	24	25	26	28
APRON AREA REQUIREMENTS (SQUARE YARDS)				
Itinerant Aircraft Apron Area	8,500	8,500	9,000	10,000
Based Aircraft Apron Area	2,100	2,400	2,400	2,400
Total Apron Area Required	**10,600**	**10,900**	**11,400**	**12,400**
CAPACITY VS. DEMAND				
Existing Terminal Area Apron Available (square yards)	6,533	6,533	6,533	6,533
Additional Apron Required	4,067	4,367	4,867	5,867

Source: WHPacific. Note: Two active based aircraft are parked; inactive aircraft are also parked using tiedowns.

AVIATION BUSINESSES AND SERVICES

FIXED BASE OPERATOR

There is no Fixed Base Operator (FBO) at the Airport, but Lewis County provides 100LL fuel at a self-serve 24/7 fueling station at the west end of the aircraft parking apron not far from the airport office. Other services offered at the Airport include airport management, aircraft

parking on the apron, courtesy transportation, a meeting area in the airport office building (L-shaped lounge area), and restrooms.

Lewis County recognized the need for better facilities, as stated in their assessment needs developed as part of the Airport Business Plan in 2010. The County has made it a short-term goal to build a new terminal/administration building and a long-term goal to attract an FBO to the Airport.

Upgrading the self-serve fuel facility and providing Jet fuel are also included as long term goals in the Airport Business Plan. The majority of survey responders indicated that the fuel facility is in need of upgrade. An airport manager from a nearby airport stated that TDO users fly to his airport to fuel.

This Master Plan recommends that the fuel facility be upgraded in the near-term.

FUEL STORAGE

There are two underground fuel storage tanks at the Airport, but one has been deactivated. The second tank (10,000 gallons), which stores 100LL fuel, has been properly lined to comply with environmental regulations.

Jet A fuel is not provided at the Airport, but is provided at Chehalis-Centralia Airport. The Airport Business Plan, 2010 makes adding Jet fuel a long-term need. WASP 2009 recommends that Community Service airports provide 100LL fuel at a minimum.

In general, it is recommended that the airport keep a supply of two weeks of fuel at its storage facility. TDO's 10,000 gallons storage tank capacity of Avgas is sufficient for the planning period considering that the Airport sold just over 10,000 gallons of fuel for all of 2012.

Providing Jet A fuel would allow more aircraft to use the airport for fueling, leading to an increase in operations and business transactions. Airport users support the future provision of Jet A fuel.

AIRCRAFT MAINTENANCE SERVICES

WASP 2009 recommends that Community Service airports provide Minor Maintenance Services. Maintenance services are generally provided by FBOs and as previously mentioned, Lewis County's Airport Business Plan has recognized the need for attracting an FBO to the

Airport. However, an A&P mechanic with a hangar at the Airport is presently providing minor maintenance services.

VEHICLE ACCESS, PARKING AND SECURITY

Vehicle access to the Airport is on a two-lane road just off Jackson Highway. Limited unmarked parking is available at the airport office building. The airport system manager indicated that airport tenants often drive onto the aircraft apron and taxiway and down to the hangar area. Others drive on the main access north of the hangars. “No Parking” signs were required in some areas to keep traffic from congesting the circulation areas. Hangar tenants typically park in their hangars or outside the hangars on the grass.

The Airport Business Plan 2010 recognizes the importance of the airport’s entrance and makes creating a clear, attractive, safe airport entrance with signage and street appeal a short-term/immediate need.

It is recommended that the construction of the new terminal/ administration building include the construction of an adjacent parking lot. The number of parking spaces must be calculated based on the expected demand which is subject to many variables including the presence of an FBO and the type of services provided in the new terminal.

Presently, the entrance to the existing airport office and hangar area is from two different locations off Jackson Highway causing confusion for transient pilots.

AIRPORT SUPPORT

The airport support section will address emergency services, airport maintenance, fencing, utilities and ground transportation.

EMERGENCY SERVICES

Emergency services include firefighting and law enforcement for the Airport. The Lewis County Sheriff’s Department provides law enforcement support. Firefighting support is provided by both a volunteer fire department and the additional support from the Lewis County Fire Department, District #2.

The emergency service equipment and staff are adequate to serve the emergency service needs of the Airport throughout the planning period. Based on FAA regulations, TDO is not required to

provide Aircraft Rescue and Fire Fighting (ARFF) since the Airport does not have the commercial passenger service that would require a Part 139 certificate.

AIRPORT MAINTENANCE

Routine airport maintenance is performed by Lewis County staff, but contractual services provide mowing four times per year—typically May, June, July, and August.

Survey respondents were particularly unsatisfied with the grass mowing services provided. Grass mowing is needed, particularly in the infield areas. Routine airport maintenance is needed to enhance airport aesthetics, which plays a role in attracting users as well as businesses.

An equipment building to store airport maintenance equipment should be identified in the long-term to keep hangars available for aircraft storage.

AIRPORT SECURITY

General aviation airports have very different security needs and limited resources in comparison to airports with airline service. Recognizing the differences, the TSA created an office focused specifically on security issues affecting general aviation. To guide airport sponsors like TDO in determining what security enhancements they should consider, the TSA published Security Guidelines for General Aviation Airports (IP A-001) in May 2004. The document contains an "Airport Characteristics Measurement Tool" that uses points to assess security risks for different airport characteristics.

Table 3M summarizes the results of the Ed Carlson Memorial Field – South Lewis County Airport assessment, which totals 14 points for the existing condition and 21 points for the future.

Table 3M. GA Airport Security Assessment –TDO

Security Characteristics	*Existing Conditions*	*Future Conditions*
Location		
Within 30 nm of mass population areas	5	5
Based Aircraft		
26-100 based aircraft	2	2
Based aircraft over 12,500 lbs	-	3
Runways		
Runway length less than 5,000 feet, greater than 2,001 feet	4	4
Asphalt or concrete runway	1	1
Operations		
Flight training	3	3
Rental aircraft	-	4
Total	15	22

Source: TSA Security Guidelines for GA Airports, Consultant

Based on the current and future score of TDO on the GA Airport Security Assessment, the TSA recommends the following:

- Perimeter Control
- Protective Lighting Systems
- Personnel and vehicle Identification Systems
- Airport Community Watch program

Presently, the Airport is without ramp lighting or any exterior lighting at the airport entrance or any auto access points.

FENCING AND GATES

Fencing and gate improvements should be made to enhance airport security. Currently, perimeter fencing around the Airport is limited and primarily includes four-foot fencing to keep cattle out. There are currently no gates limiting access to the Airport operational areas. Therefore, an evaluation of the types of fencing and gates to enhance security is needed.

UTILITIES AND DRAINAGE

UTILITIES

The Airport Business Plan 2010 lists completing the expansion and development of the public water system and finishing the construction of a sewer system to serve airport needs as short

term and immediate needs. Currently, the Airport has onsite waste water treatment capabilities and the development of an onsite sewage collection system should be considered.

Airport users stated their dissatisfaction with the public water system and the lack of water availability. These issues should be addressed in the short term and have a significant effect on the airport maintaining its users and attracting future users and businesses. Additionally, the development of utilities must take into account the airport's future plans of attracting a FBO as well as commercial and industrial activities. The utilities needs of these entities/businesses must be taken into account when planning and calculating the utility needs at the Airport.

DRAINAGE

Additional development at the Airport will require an examination for stormwater impacts. Additional paved surfaces generally require development of stormwater detention or retention structures to prevent an increase in stormwater flows/intensities off the airport property. Overall, there is adequate area for the development of stormwater features in areas outside the runway/taxiway safety areas and near proposed development.