

Demand Capacity Analysis

Dillingham Airport Master Plan Update

Project No. CFAPT00353/ AIP 3-02-0078-017-2018

Prepared for:



Alaska Department of Transportation & Public Facilities
4111 Aviation Avenue
Anchorage, Alaska 99502

Prepared by:

R&M Consultants, Inc.
9101 Vanguard Drive
Anchorage AK, 99507

December 2021

The preparation of this document is supported in part with financial assistance through the Airport Improvement Program from the Federal Aviation Administration (AIP Grant Number 3-02-0078-017-2018) as provided under Title 49 USC § 47104. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein, nor does it indicate that the proposed development is environmentally acceptable in accordance with the appropriate public laws.

Table of Contents

Introduction	3
Data Sources	3
Methodology.....	4
Average Hourly Capacity	5
Inputs	5
Outputs	7
Annual Service Volume	8
Inputs	8
Outputs	8
Summary	9
References	10

List of Figures

Figure 1: 5010 Operations Count at DLG (2018).....	4
Figure 2: TranStats: DLG (2019)	9

List of Tables

Table 1: DLG Operating Fleet Mix by Aircraft Classification.....	5
Table 2: FAA Aircraft Classifications.....	6
Table 3: Average Runway Occupancy and Approach Speeds	6
Table 4: Arrival-Arrival Separation Requirements	7
Table 5: Departure-Departure Separation Requirements	7
Table 6: Hourly Capacity at DLG.....	8

List of Acronyms

ACRP	Airport Cooperative Research Program
AMP	Airport Master Plan
ASV	Annual Service Volume
BTS	Bureau of Transportation Statistics
DLG	Dillingham Airport
DOT&PF	Department of Transportation and Public Facilities
FAA	Federal Aviation Administration
FSS	Flight Service Station
GA	General Aviation
IMC	Instrument Meteorological Conditions
NPIAS	National Plan of Integrated Airport Systems
RW	Runway
VMC	Visual Meteorological Conditions

Introduction

The following Demand Capacity Analysis for Dillingham Airport (DLG) supports the State of Alaska Department of Transportation & Public Facilities' (DOT&PF) Dillingham Airport Master Plan (AMP) update.

The purpose of this analysis is to determine:

1. DLG's hourly and annual capacity to facilitate air traffic
2. How current demand relates to capacity

Regarding hourly capacity, this analysis estimates that DLG can accommodate 68 mixed operations (arrivals and departures) during Visual Meteorological Conditions (VMC) and 42 mixed operations during Instrument Meteorological Conditions (IMC).

Annual capacity at DLG is estimated at 118,530 operations. On an annual basis, demand is an estimated 20.1% of capacity, although demand increases to 78% of capacity in July—the peak month.

The following sections discuss:

1. Data sources used to determine demand and capacity
2. Methodology used
3. Inputs and outputs associated with estimating DLG's hourly and annual capacities.

Data Sources

The following data sources were used in determining DLG's demand and capacity.

T-100 Dataset

The Bureau of Transportation Statistics (BTS) T-100 data from 2019¹ was used for the DLG Aviation Activity Forecast. This was used to determine the monthly and annual operations breakdown by aircraft classification. These numbers applied to commercial operations reported by air carriers.

5010 Master Record

Since the T-100 only shows reported commercial operations, the 5010 Master Record was consulted to estimate general aviation (GA) operations. The significant limitation with this data source is that the reported number of GA operations has not been updated since 2007. Operations data in the 5010 are considered less reliable for non-towered airports with fewer than 100,000 enplanements (e.g. DLG), due to being updated less frequently. The 5010 Master Record was accessed for DLG via the Airport Data and Information Portal (ADIP).² See Figure 1.

¹ "T-100 Domestic Segment," Bureau of Transportation Statistics, 2010-2018.

² "(DLG) Dillingham," Airport Data and Information Portal (ADIP), Federal Aviation Administration, October 7, 2021.

Annual Operations	
Air Carrier:	1,323
Air Taxi:	36,489
General Aviation Local:	2,083
General Aviation Itinerant:	10,986
Military:	11
TOTAL OPERATIONS:	50,892
Operations for 12 Months Ending:	12/31/2018

Figure 1: 5010 Operations Count at DLG (Accessed 2018)

BTS TranStats

BTS TranStats was used to determine the average amount of delay experienced at DLG in 2019.

Spreadsheet Capacity Model

This Excel spreadsheet model was provided by FAA and is used to calculate the hourly aircraft operations capacity of an airport.

Annual Service Volume (ASV) Estimation Model

This Excel spreadsheet model was provided by FAA and is used to calculate the annual aircraft operations capacity of an airport.

Methodology

Guidance for estimating airport capacity was provided in the Airport Cooperative Research Program Report 79 (ACRP 79), *Evaluating Airfield Capacity* and the accompanying *Prototype Airfield Capacity Spreadsheet Model User's Guide*.

ACRP 79 was preferred over the 1983 AC 150/5060-5, *Airport Capacity and Delay*, since the latter is more suited to large airports with multiple runways to allow some separation of operations by aircraft class—as opposed to DLG where all operations utilize Runway 1-19. AC 150/5060-5 also has assumptions built into the lookup tables that limit planners' ability to modify capacity calculations when airport variables deviate from those assumptions. For airports like DLG, where utility aircraft comprise most of the fleet mix, AC 150/5060-5 does not adequately capture the actual capacity.

This analysis determines “maximum sustainable throughput” to compare demand and capacity at DLG. Determining maximum sustainable throughput answers the question, “How many aircraft operations can an airfield reasonably accommodate in a given period of time when there is a continuous demand for service during that period?”³

DLG capacity estimates include Annual Service Volume (ASV) and average hourly capacity levels. These were estimated using the spreadsheet models developed for ACRP Report 79, *Evaluating Airport Capacity*. ASV utilizes a simpler spreadsheet model that accounts for differences in runway use, aircraft mix, and weather conditions expected to occur over a typical year, whereas the average hourly capacity estimate focuses on the maximum number of operations that DLG can facilitate in one hour.

³ ACRP Report 79, *Evaluating Airfield Capacity*, The National Academies Press, (2012): 3.

Since robust data were not available to determine the exact fleet mix of GA aircraft when calculating the total fleet mix at DLG, two GA scenarios were tested for sensitivity analysis. In the first scenario, all GA aircraft listed in the 5010 were assumed to be single engine aircraft with a maximum takeoff weight (MTOW) less than 12,500 pounds. In the second scenario, review of the most recent aerial imagery of DLG’s GA apron revealed approximately 13% of the aircraft to be twin-engine aircraft, assumed to have an MTOW less than 12,500 pounds. Both mixes were used in the spreadsheet model to determine whether there was a significant difference in hourly capacity.

Average Hourly Capacity

Average hourly capacity refers to the number of operations an airport can sustainably facilitate each hour.⁴

Runway (RW) 1-19 is the only runway at DLG, so there is no separation of Class A-D aircraft, which use RW 1-19 for 100% of DLG operations. Some smaller aircraft with tundra tires use the gravel embankment to the adjacent northwest of RW 1-19 to land, although this is not its intended or permitted use. As such, this area is not considered to increase hourly capacity.

RW 1-19 can be accessed via perpendicular taxiways A or B. Since there is no parallel taxiway, aircraft must taxi on the runway and turn around before taking off. This is inefficient and can add to delays, particularly during the summer fishing season when DLG experiences its highest air traffic volumes.

Inputs

The following variables listed in ACRP 79,⁵ were determined for DLG and input into the FAA Airfield Capacity Spreadsheet Model for single-runway airports.

Aircraft Fleet Mix

Table 1 shows the operating fleet mix at DLG by aircraft classification under the first GA aircraft scenario, with 100% of the GA aircraft in the Small-S category. The second scenario, with 87% Small-S and 13% Small-T GA aircraft, resulted in the total Small-S and Small-T operations percentages at 75.4% and 11.9%, respectively. The remaining categories were not affected. Table 2 describes the aircraft categories used in the spreadsheet model.

Table 1: DLG Operating Fleet Mix by Aircraft Classification (2019)

Aircraft Class New Category	Small - S	Small - T	Small +	Large-Turboprop	Large-Jet	Large-757	Heavy
Previous FAA Category	A	B	C	C	C	C	D
Percentage of Operations (Scenario 1)	81.4%	5.9%	0.0%	9.2%	3.5%	0.0%	0.0%
Percentage of Operations (Scenario 2)	75.4%	11.9%	0.0%	9.2%	3.5%	0.0%	0.0%

⁴ ACRP Report 79, *Evaluating Airfield Capacity*, The National Academies Press, (2012): 3.

⁵ Ibid, 49.

Table 2: FAA Aircraft Classifications

Aircraft Classification	Small - S	Small - T	Small +	Large-TP	Large-Jet	Large-757	Heavy
New Category							
Previous FAA Category	A	B	C	C	C	C	D
Maximum Gross Takeoff Weight (MTOW)	Less than 12,500 lbs. (Single Engine)	Less than 12,500 lbs. (Twin Engine)	Between 12,500 lbs. and 41,000 lbs.	Between 41,000 lbs. and 255,000 lbs.	Between 41,000 lbs. and 300,000 lbs.	Boeing 757 Series	More than 300,000 lbs.

VMC vs. IMC

Excluding no-fly conditions, VMC occurs 81.72% of the time and IMC occurs 18.28% of the time at DLG. Wind data observations at DLG from 2011-2020 were used to determine these percentages.

Arrival runway occupancy time & approach speeds

Average runway occupancy times were separated by aircraft class (Table 3).

Table 3: Average Runway Occupancy and Approach Speeds

Aircraft Class New Category	Small - S	Small - T	Small +	Large-Turboprop	Large-Jet	Large-757	Heavy
Arrival RW Occupancy Time (Seconds)	32	40	42	45	46	51	55
Average Approach Speeds (Knots)	90	100	120	130	135	140	150

Runway exit availability

There are two available runway exits.

Type of parallel taxiway (i.e. full, partial, or none)

There is no parallel taxiway.

Availability of an air traffic control tower

There is no air traffic control tower.

Runway crossings

There are no runway crossings.

Percent of touch-and-go activity

0% touch-and-go activity was assumed.

Length of common approach

The common approach length used was 12 nautical miles.

Departure-arrival separation

Departure-arrival separation inputs were 3.5 nautical miles during VMC and 5 nautical miles during IMC.

Arrival gap spacing buffer

The arrival gap spacing buffer input was 10 nautical miles.

Departure hold buffer

Departure hold buffer was kept at the spreadsheet default

Arrival-arrival & departure-departure separation requirements

The default values were used for arrival-arrival and departure-departure separation requirements (Tables 4 and 5).

Table 4: Arrival-Arrival Separation Requirements

Trailing Aircraft	Leading Aircraft	Distance in Nautical Miles	
		VMC	IMC
Small-S --- Heavy	Small-S, Small-T	1.9	3.0
Small-S --- Small+	Small+	1.9	3.0
Large --- Heavy	Small+	1.9	3.0
Small-S --- Small+	Large-TP, Large-Jet	2.7	4.0
Large --- Heavy	Large-TP, Large-Jet	1.9	3.0
Small-S --- Small+	Large-757	3.7	5.0
Large --- Heavy	Large-757	2.7	4.0
Small-S --- Small-T	Heavy	4.6	6.0
Small+ --- 757	Heavy	3.6	5.0
Heavy	Heavy	2.7	4.0

Table 5: Departure-Departure Separation Requirements

Trailing Aircraft	Leading Aircraft	Time in Seconds	
		VMC	IMC
Small-S --- Small+	Small-S --- Small+	35	60
Large-TP --- Large-757	Small-S --- Small+	45	60
Heavy	Small-S --- Small+	50	60
Small-S --- Small+	Large-TP, Large-Jet	80	80
Large --- Heavy	Large-TP, Large-Jet	60	60
Small-S --- Large-Jet	Large-757, Heavy	120	120
Large-757, Heavy	Large-757, Heavy	90	90

Outputs

Given the inputs used, Table 6 shows the hourly capacity at DLG. The capacity changes based on the given meteorological conditions (i.e. VMC and IMC) and type of operations (i.e. arrivals only, departures only, and mixed operations). Scenarios 1 and 2, depicting different GA aircraft fleet mixes, did not affect hourly capacity at DLG.

Table 6: Hourly Capacity at DLG

	VMC	IMC	Average
Arrivals Only Capacity	3	3	3
Arrivals Capacity (including TNG's)	3	3	3
Departures Only Capacity	87	58	81
Mixed Ops – Departure Capacity (including TNG's)	64	39	60
Total Mixed Operations Capacity	68	42	63
Arrivals Percentage	5%	7%	5%

Annual Service Volume

Annual Service Volume (ASV) refers to an airport's capacity to facilitate operations over a span of one year.⁶

Inputs

The following variables were determined for DLG and input into the ASV estimation spreadsheet model.

Annual Demand

Annual demand was 23,841, based on the 2019 T-100 operations for DLG and the 5010 Master Record that showed the estimated general aviation operations. Using 2019 operations ensures consistency with the Aviation Forecast report and is a better source than 2020 data for analysis, since COVID-19 impacts significantly affected 2020 operations.

Average Peak Month Daily Demand

July is the peak month at DLG with an estimated 2019 demand of 7,750, based on the DLG Flight Service Station (FSS) estimate of 250 average daily operations in July (i.e. 250 operations * 31 days).

Average Peak Hour Demand

The estimated average peak hour demand is 10.42, based on dividing the average peak month daily demand by 24 hours. A specific average peak hour demand was not provided.

VMC vs. IMC Occurrence and Hourly Capacity

Using the average Hourly Capacity inputs and outputs, VMC occurs 81.72% of the time and IMC occurs 18.28%. VMC hourly capacity is 68 operations, and IMC hourly capacity is 42 operations.

Maintenance

Maintenance activities, such as snow removal, painting, and crack sealing lower the total time that a runway can be used for operations. A 10% reduction in annual service volume was assumed. It is possible that the estimated maintenance reduction is low, affecting the calculated annual capacity.

Outputs

Given the input values used, the estimated ASV is 118,530. The ASV spreadsheet model shows 131,700 annual operations since the 10% operations reduction for maintenance activities was not included. With

⁶ ACRP Report 79, *Evaluating Airfield Capacity*, The National Academies Press, (2012): 3.

an annual demand of 23,841 operations, the annual demand capacity ratio is approximately 0.201, meaning that current demand is 20.1% of available capacity.

Due to the highly seasonal nature of DLG operations, this capacity estimate can be somewhat misleading. In the winter months, operations may be well below demand, whereas demand may meet or exceed capacity during peak hours in the summer months when the fishing industry is most active. BTS TranStats shows an average delay between 30.22 and 51.11 minutes from 2016 to 2021⁷ (Figure 2). Delays indicate capacity exceedance.

To further illustrate, an annual capacity of 118,530 indicates a monthly capacity of approximately 9,878 (i.e. 118,530/12). At 7,750 July operations, July’s demand could, on average, be closer to 78% of capacity.

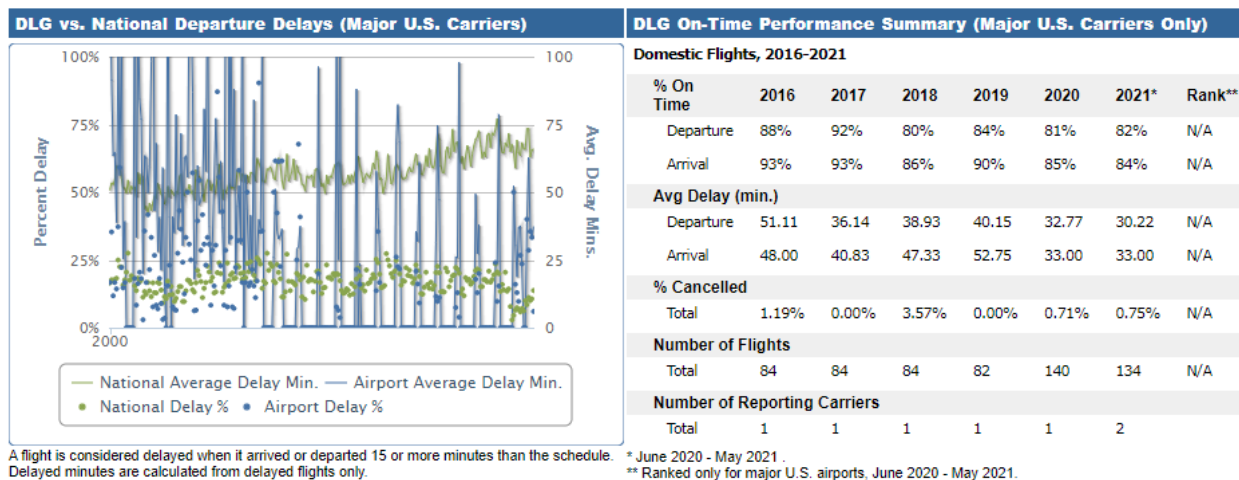


Figure 2: TranStats: DLG (2019)

Summary

This demand-capacity analysis yielded the average hourly capacity and annual service volume at DLG.

Average hourly capacity analysis estimated that DLG can accommodate 68 mixed operations (arrivals and departures) during Visual Meteorological Conditions (VMC) and 42 mixed operations during Instrument Meteorological Conditions (IMC). Arrivals accounted for 5% and 7% of VMC and IMC hourly capacity, respectively.

Annual capacity at DLG is estimated at 118,530 operations. On an annual basis, demand is an estimated 20.1% of capacity, although demand increases to 78% of capacity in July—the peak month. A limitation of this estimate is that aggregation to yearly or monthly demand does not account for days or hours when demand at DLG may exceed capacity. Airport congestion will affect the movement of fresh fish and game, which is sensitive to delays.

⁷ “Dillingham, AK: Dillingham Airport (DLG),” Bureau of Transportation Statistics, December 31, 2019.

References

- Bureau of Transportation Statistics. 2019. "Dillingham, AK: Dillingham Airport (DLG)." *TransStats*. December. <https://www.transtats.bts.gov/airports.asp?20=E>.
- . 2010-2019. "T-100 Domestic Segment." *United States Department of Transportation*. https://www.transtats.bts.gov/databases.asp?Z1qr_VQ=E&Z1qr_Qr5p=N8vn6v10&f7owrp6_VQF=D.
- Federal Aviation Administration. 2021. "(DLG) Dillingham." *Airport Data and Information Portal (ADIP)*. October 7. <https://adip.faa.gov/agis/public/#/airportData/DLG>.
- Fisher, Leigh; Airport Cooperative Research Program; Transportation Research Board; National Academies of Sciences, Engineering, and Medicine. 2012. *ACRP Report 79, Evaluating Airfield Capacity*. Report, Washington, D.C.: The National Academies Press.