THE ANALYSIS OF GENERAL AVIATION AIRPORT IN UNITED STATES

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ABSTRACT

This research aims to observe and analyze general aviation airports all around United States and give a suggestion for general aviation airport service in Thailand. Purposive sampling was used to collect data from 696 airports. The data were analyzed by descriptive statistics, Chi-square, and Pearson correlation coefficient. The result showed that the most frequent airport is in Texas. The maximum runway length is 2,591 meters, and the minimum runway length is 529 meters. The service provided consists of parking, fuel, airframe service, powerplant service, oxygen bottles, and bulk oxygen. The result from Chi-square test found that there was a significant relationship between category of airport length and airport service frequency. In addition, Person correlation coefficient analysis found a slight correlation in the same direction in runway length and runway width. Finally, it is suggested that Thailand should consider general aviation airport length depending on the type of aircraft landing, and airport service should have between 0 and 6 facilities. Lastly, research to optimize runway length and optimize the number of airport service facilities should continue.

Keywords: General Aviation, Airport, Service.

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INTRODUCTION

General aviation (GA) is essentials part of the aviation by its diversity, flexibility, and contribution to both the aviation industry and society, it can create many business including tourism, local community, air sport, flight school, etc. which can create 1.1 million jobs and US$246 billion in United States (Wood, Online, 2023) and expected to reach US$24.01 billion by 2030 (Mordor Intelligence, Online, 2024), in Europe GA is expected to reach US$9.29 billion by 2030 (Mordor Intelligence, Online, 2024) also in Asia Pacific GA market is expected to reach US$4.27 billion by 2030. (Mordor Intelligence, Online, 2024)

Thailand nation strategy (2018 to 2037) in term of competitiveness enhancement, sub topic in creating diversity tourism and another related topic in air transport, general aviation is one of the strategies to achieve it (Suppacha Phetsome, Nuansamorn Ounhaprateep & Natthakan Phachan, 2020, pp. 31-50). Thailand has a lot of general aviation airport around the country such as Pattaya airpark, Phuket airpark, Bang Phra airport, Ban Thi airport. Etc., however It should be made airports have international standard to promote tourism, especially by increasing the provision of services related to aircraft. (European Union Aviation Safety Agency 2025, Online, 2025)

From above background, we have attention get more knowledge in general aviation airport in United States which has highest income in GA with objective to observe and analyze data in general aviation airports all around United State and give a suggestion for general aviation airport service along with provide information for the development of general aviation in Thailand.

OBJECTIVES

1. To observes data from general aviation airport in United States.
2. To analyzes data from general aviation airport in United States.

RESEARCH HYPOTHESIS

1. Is there moderate correlation in runway length and runway width?
2. Is there significant relationship between category of airport length and airport service frequency?

CONCEPTUAL FRAMEWORK

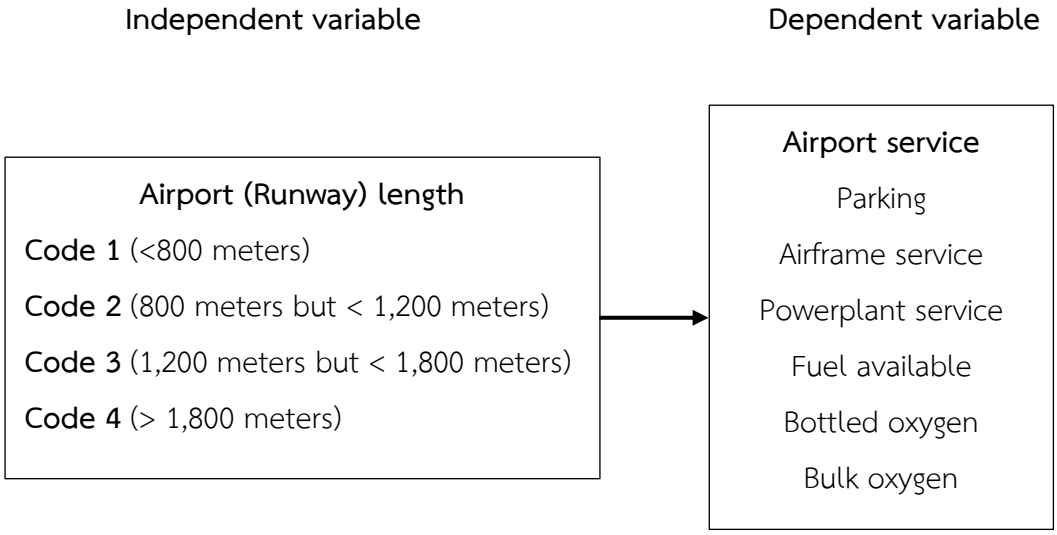

Figure 1 Conceptaul Framework

LITERATURES REVIEW

General aviation airport

General aviation is defined by the International Civil Aviation Organization (ICAO) as all civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire. The category also is sometimes called general aviation (GA) aerial work (AW). Example of GA is corporate aviation, private travel, air tourism, air sport. Example of AW is aerial survey, firefighting, pilot training. (IAOPA, Online, 2024) In GA there may have Fixed base operator (FBO) who is commercial enterprise that has been granted the right by an airport authority to operate and provide aviation services such as Parking, Fuel, Aircraft catering, Airframe service, Powerplant service, Car rental, Bottle oxygen, and Bulk oxygen, Etc. (Skybrary, Online, 2025)

General aviation airport is one of the airport activities it may be a part of reliever airport and it is a public-use airport that does not have scheduled service or has scheduled service with less than 2,500 passengers/year. GA airport is categories as basic airport which link the community with the national airport system and supports general aviation activities such as emergency response, air ambulance service, flight training, and personal flying. (Federal Aviation Administration, Online, 2024) There is a lot GA airport in Thailand around the country such as Pattaya airpark, Phuket airpark, Bang Phra airport, Ban Thi airport. Etc.

Example of research GA airport such as, improving airports (Weisrod, 1991, pp. 67-83) functions and benefits of airport (Newkirk & Casavant, 2002, pp. 80-87), status in disaster response planning (Smith, 2011, pp. 1-13), operation for airport sustainability (Gu & Johnson, 2020, pp. 608-620), determinants and strategies airport's performance. (Giovanelli & Rotondo, 2022, pp. 1-14)

From a review of research there are no information in general aviation airport facility, so we have questions about how many facilities in general aviation airport should have to provide service to aircraft, relationship between length and width of runway, relationship between airport service and runway length (code 1-4) to give a suggestion for developing general aviation airport in Thailand.

Chi-square (X^2)

Chi-square test is a data analysis technique used with qualitative or quantitative data that is divided into ranges and the data does not have to be normally distributed. The digits used in the chi-square test are the frequencies of each level of the variable to be studied. The principle of the Chi-square test is to compare the frequency obtained from observed frequency (Oi) with expected frequency (Ei). Chi-square has two categories and different assumption for the test of independence, which asks a question of relationship and the goodness-of-fit test, which asks a theoretical question. In additional degrees of freedom are used to determine if a certain null hypothesis can be rejected based on the total number of variables and samples within the experiment. (Hayes, Online, 2024)

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i} \quad (1)$$

Where:

C = Degree of freedom

O = Observed frequency

E = Expected frequency

Pearson correlation (*r*)

The Pearson correlation coefficient (*r*) examines the relationship between two variables. strength and direction of the correlation in the Pearson correlation coefficient (*r*) has -1.0 to +1.0 if *r* value is between 0.00 and 0.30 (-0.30 and 0.00), it means there is a slight correlation in same direction (opposite direction). If *r* value is between 0.31 and 0.50 (-0.50 and -0.31), it

means there is a low correlation in same direction (opposite direction). If *r* value is between 0.51 and 0.70 (-0.70 and -0.51), it means there is a moderate correlation in same direction (opposite direction). If *r* value is between 0.71 and 0.90 (-0.90 and -0.71), it means there is a high correlation in same direction (opposite direction). If *r* value is between 0.91 and 1.00 (-1.00 and -0.91), it means there is a very high correlation in same direction (opposite direction). (Statistics How To, Online, 2023)

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}} \quad (2)$$

Where:

r = Correlation coefficient

n = Number of populations

x = Independent variable

y = Dependent variable

∑ = Summation

METHODOLOGY

This document research uses purposive sampling method (Parvathi Vijayamohan, Online, 2025) to collect secondary data from general aviation airport in United States website of 696 municipal airports with single runway all 51 states of America including District of Columbia. For answer research question data will consists of runway length, runway width and airside service in general aviation airport. Length is categorized into code 1-4 (Skybrary, Online, 2024), code 1 length less than 800 meters, code 2 length between 800-1,199 meters, code 3 length between 1,200-1,799 meters and code 4 length 1,800 meters and above.

Data is recorded to spreadsheet program and analyzed by descriptive statistics (Green, Manski, Hansen & Broatch, 2022, pp. 1-12) such as frequency, percentage, maximum value, minimum value to answer research objective together with equation 1 and 2 to answer research question.

RESULT

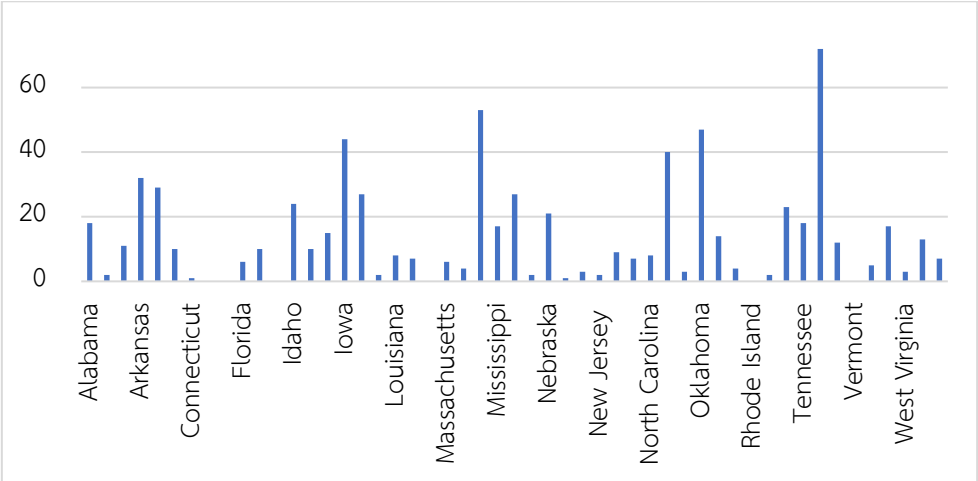

Figure 2 Frequency of general aviation airports in each State

From figure 2 All airports frequency is 696 airports. *X* axis shows name of the State, *Y* axis shows number of frequencies. The most frequency of airports is in Texas 72 airports, the least frequency of airport is 0 (No airport meet criteria in sample group) in Delaware, District of Columbia, Hawaii, Maryland, Rhode Island and Vermont

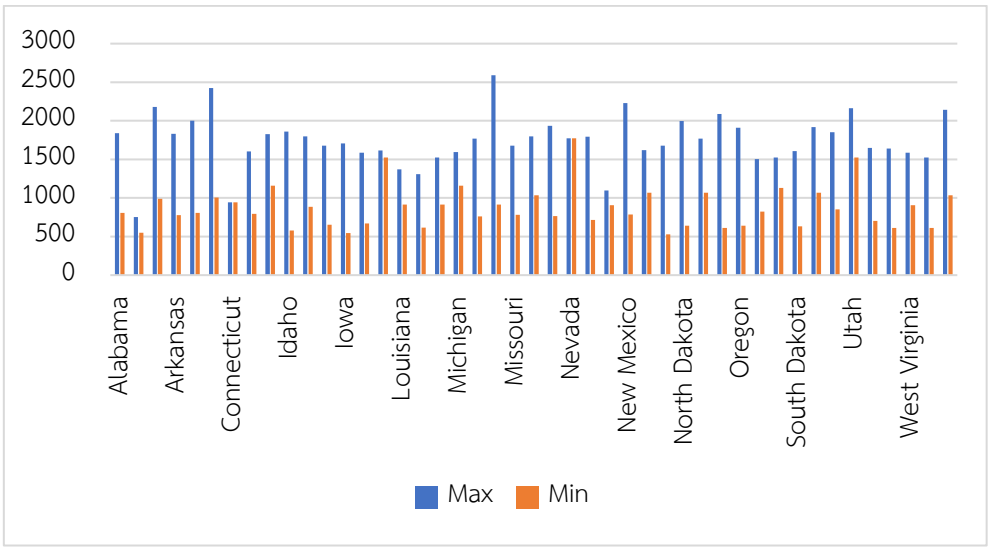

Figure 3 Maximum and minimum of runway length

From figure 3, *X* axis shows name of the State, *Y* axis shows length of the runway (Meters). Tunica municipal airport in Mississippi has maximum length 2,591 meters (8,500 feet), Yanceyville municipal airport in North Carolina has minimum length 529 meters (1,736 feet)

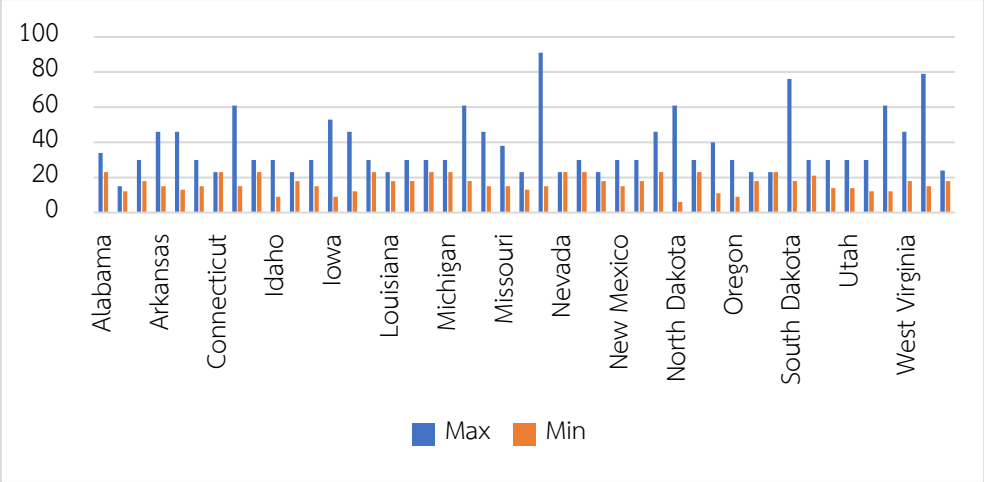

Figure 4 Maximum and minimum of runway width

From figure 4, *X* axis shows name of the State, *Y* axis shows width of the runway (Meters). Hay Springs municipal airport in Nebraska has maximum width 91 meters (299 feet), Minto municipal airport in North Dakota has minimum width 6 meters (20 feet).

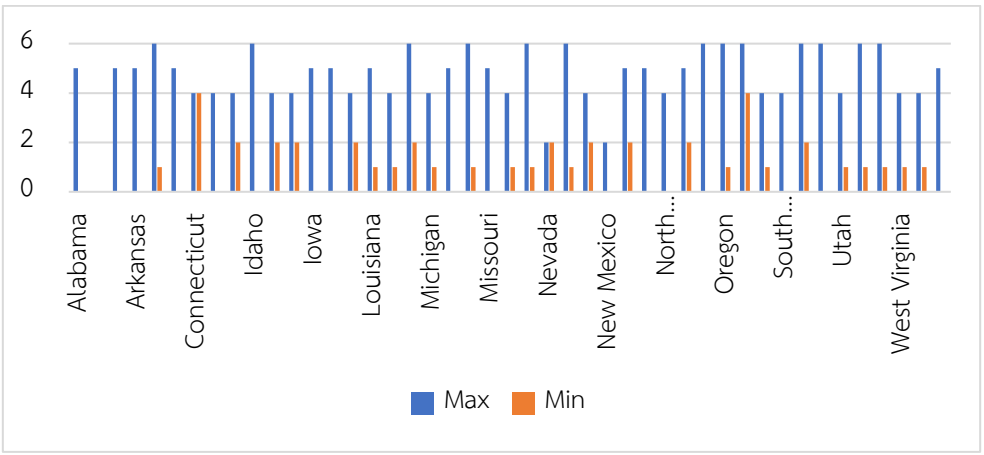

Figure 5 Maximum and Minimum of airport service

From figure 5, *X* axis shows name of the State, *Y* axis shows number of services of the following, 0="No service". 1=airport has service in "Parking", 2=airport has service in "Parking"

and "Fuel". 3=airport has service "Parking", "Fuel" and Airframe service". 4=airport has service in "Parking", "Fuel", "Airframe service" and "Powerplant service". 5=airport has service in "Parking", "Fuel", "Airframe service", "Powerplant service", and "Bottle oxygen". 6=airport has service in "Parking", "Fuel", "Airframe service", "Powerplant service", "Bottle oxygen" and "Bulk oxygen". Maximum airport service (6) in California: Auburn municipal airport, Fullerton municipal airport, Hawthorne municipal airport, Petaluma municipal airport, and Santa Monica municipal airport. In Idaho: Gooding municipal airport. In Massachusetts: Marshfield municipal airport. In Mississippi: Tunica municipal airport. In Nebraska: Fremont municipal airport. In New Hampshire: Laconia municipal airport. In Oklahoma: Pauls Valley municipal airport. In Oregon: Bend municipal airport. In Pennsylvania: Zelienople municipal airport. In Tennessee: Murfreesboro municipal airport and Scott municipal airport. In Texas: Gatesville municipal airport. In Virginia: Hanover County municipal airport. In Washington: Renton municipal airport.

Minimum airport service (0) in Alabama: Addison municipal airport. In Alaska: Kodiak municipal airport and Butte municipal airport. In Arizona: Superior municipal airport. In Arkansas: Hampton municipal airport. In Colorado: Saguache municipal airport. In Florida: Belle Glade State municipal airport. In Idaho: Oakley municipal airport. In Iowa: Allison municipal airport and Mount Ayr municipal airport, Sully municipal airport, and Woodbine municipal airport. In Kansas: Yates Center municipal airport. In Minnesota: Karlstad municipal airport and Starbuck municipal airport. In Missouri: Kahoka municipal airport, Lincoln municipal airport, and Richland municipal airport. In New Mexico: Mountainair municipal airport and Vaughn municipal airport. In North Carolina: Yanceyville municipal airport. In North Dakota: Hazelton municipal airport, Leeds municipal airport, and Mc Clusky municipal airport. In Oklahoma: Freedom municipal airport, Madill municipal airport, Olustee municipal airport, Tipton municipal airport, and Vici municipal airport. In South Dakota: Groton municipal airport, Kimball municipal airport, and White River municipal airport. In Texas: Newton municipal airport and Pineland municipal airport. In Wyoming: Upton municipal airport.

Table 1 Calculate of correlation (*r*) in runway length (*x*) and runway width (*y*)

n	*x*	*y*	*xy*	x^2	y^2
1	884	24	21216	781456	576
2	806	34	27404	649636	1156
3	1524	24	36576	2322576	576
4	1676	24	40224	2808976	576
5	1312	24	31488	1721344	576
6	1527	24	36648	2331729	576
7	1548	30	46440	2396304	900
8	974	23	22402	948676	529
9	1128	23	25944	1272384	529
...	...	...	...	...	...
696	1131	24	27144	1279161	576

Table 1 shows calculation Calculate of correlation (*r*) in runway length (*x*) and runway width (*y*) from 1st airport to 696th airport.

Table 2 Result of correlation (*r*) in runway length (*x*) and runway width (*y*)

Person correlation (r)	0.092

Table 2 shows result of correlation in runway length (*x*) and runway width (y), r=0.092 means there is a slight correlation in same direction.

Table 3 Observed frequency between category of airport length and airport service frequency.

Airport service	**Parking**	**Airframe service**	**Powerplant service**	**Fuel available**	**Bottled oxygen**	**Bulk oxygen**	**Total**
Code 1	43	3	3	5	0	0	54
Code 2	308	87	85	190	11	8	689
Code 3	272	147	143	237	25	16	840
Code 4	37	26	26	35	9	5	138
Total	**660**	**263**	**257**	**467**	**45**	**29**	**1721**

Table 4 Expected frequency between category of airport length and airport service frequency.

Airport service	Parking	Airframe service	Powerplant service	Fuel available	Bottled oxygen	Bulk oxygen
Code 1	20.709	8.252	8.064	14.653	1.412	0.910
Code 2	264.23	105.292	102.890	186.963	18.016	11.610
Code 3	322.14	128.367	125.439	227.937	21.964	14.155
Code 4	52.923	21.089	20.608	37.447	3.608	2.325

Table 5 Test statistic of category of airport length and airport service frequency.

Statistic details	Value of statistic
Alpha value	0.05
Degree of freedom	15
Test statistic	89.266
Critical value	24.995

From Table 5 Test statistic higher than critical value, so can conclude that there is significant relationship between category of airport length and airport service frequency at alpha 0.05. (Statistic How To, Online, 2024)

CONCLUSION AND DISCUSSION

This research collected data from 696 municipal airports all 51 states of America including District of Columbia which have single runway. We observed then found that the most frequency of airports is Texas 72 airports and the least frequency of airport is 0 airport (No airport meet criteria) in Delaware, District of Columbia, Hawaii, Maryland, Rhode Island, and Vermont. The maximum length of runway is 2,591 meters from Tunica municipal airport in Mississippi and minimum length of runway is 529 meters from Yanceyville municipal airport in North Carolina. The maximum width of runway is 91 meters from Hay Springs municipal airport in Nebraska and minimum width of runway is 6 meters from Minto municipal airport in North Dakota.

We analyzed to answer research then found that General aviation airport has no service (0) to 6 services ("Parking", "Fuel", "Airframe service", "Powerplant service", "Bottle oxygen" and "Bulk oxygen") Sarun Dunsathit (2022, pp. 65-83). Relationship between length and width of

runway have a slight correlation in same direction. Finally, it has significant relationship between airport service and runway length.

From maximum runway length is 2,591 meters with runway code 4 in Tunica municipal airport because this airport commercial airline used to land here 2006-2011 (WikipediA, Online, 2024). Yanceyville municipal airport in North Carolina has minimum runway length 529 meters (Code 1) because this airport only supports for private aircraft (Aircraft Owners and Pilots Association, Online, 2024). We found that the maximum of airport is 6 service facilities in consistence with Chankoson (2016, pp. 78-88) said that airport facilitation is significance factor to air transport development and consistence with Arthaphon Chanchaliew (2008, pp. 32-34) said that general aviation airport should consist of 6 type of services. Relationship between length and width of runway have a slight correlation in same direction this because in general aviation there is no limitations on runway width (Federal Aviation Administration, Online, 2024). Airport service and runway length has significant relationship because longer runway length means more type of aircraft landing so airport have to provide service facility to aircraft, it's consistence with Federal Aviation Administration (Online, 2024).

SUGGESTION

From result we would like to give a suggestion for developing general aviation airport in Thailand, Thailand should consider general aviation airport length depend on type of aircraft landing and airport service should have between 0-6 facilities. However, to save a cost of construction we should have to find how runway length should be and find how many the number of airport services should have. So, in the next research we would like find the optimal of runway length and number of airport service by applied machine learning to find the answer.

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