ANALYSIS OF THE NEED FOR AIRCRAFT TOWING TRACTOR (ATT) TO SUPPORT GROUND HANDLING OPERATIONAL ACTIVITIES IN 2043 AT DJALALUDDIN GORONTALO AIRPORT

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ABSTRACT

Good airport operational development planning is needed in analyzing the need for Aircraft Towing Tractors (ATT). Forecasting the number of passengers in the next 25 years uses the linear regression method via Microsoft Excel and SPSS software. This method is also used to determine the number of passengers during busy times to calculate the need for an Aircraft Towing Tractor (ATT). In 2043, the predicted number of passengers will reach 2,507,044 pax/year. By forecasting the number of passengers during busy times, it was found to be 6,969 passengers. For the predicted number of passengers, the need for Aircraft Towing Tractors (ATT) in 2043 at Djalaluddin Gorontalo Airport will be 9 (nine) units.

Keywords: Djalaluddin Gorontalo Airport, Aircraft Towing Tractor (ATT) Needs, Linear Regression Method, Passenger Busy Time (PWS).

1. INTRODUCTION

Air transportation is one of the most important modes of transportation in Indonesian life today. Air transportation allows people to move goods and people in just a matter of hours. Something that is very impossible to do using sea transportation modes or land transportation modes. Therefore, the existence of air transportation modes is becoming increasingly important today. This is considering the human need for a means of transportation that is fast, safe, comfortable at an affordable price. This situation is good for providing opportunities for certain groups to establish airline companies to meet the demands of efficient transportation needs.

Airport is everything that has a bond with the implementation of an activity at the airport in carrying out the functions of safety, security, smoothness, and orderliness of aircraft traffic, passengers, cargo and / or posts, intra and / or intermodal transfer places and increasing regional and national economic growth. In all of these activities there are several officers in accordance with their fields who have their respective expertise. Apron Movement Control personnel is a personnel in charge of organizing and supervising all movements contained on the apron of an airport. Such as the movement of Ground Support Equipment (GSE) which is used as a supporting tool for airport activities and is operated by Ground Handling personnel. Ground Handling personnel are personnel who provide services and handling for aircraft while on the ground.

In airport operational activities, of course there are several aspects that require equipment to support their activities (Ground Support Equipment). In these supporting tools are also distinguished according to their functions and uses, Aircraft Towing Tractor (ATT) is used to pull and push (pushback) aircraft. GSE needs are certainly adjusted to the movement or number of aircraft at the airport, GSE equipment also has an age limit in accordance with PM 91 of 2016, which is within a maximum period of 10 years. but in Djalaluddin Gorontalo Airport has a lack of GSE equipment,

especially in vehicles or Aircraft Towing Tractor (ATT) tools that are not in accordance with the number of aircraft at peak hours at the airport and also not in accordance with PM 91 of 2016 because the Aircraft Towing Tractor (ATT) at Djalaluddin Gorontalo Airport has been running for 13 years [1].

To smooth the course of Ground Handling activities at Djalaluddin Airport in the coming years, it is necessary to plan an update or development of equipment in accordance with the conditions of the number of passengers who will increase using air transportation modes at Djalaluddin Gorontalo Airport. Based on previous research related to the need for Aircraft Towing Tractor (ATT) (Wibowo, W, R., & Hilal, F, R., 2023) Ground Handling performance is fairly inefficient, because work in the airside area is constrained by the lack of Aircraft Towing Tractor (ATT) [2].

Based on the background description above, the researchers found the following problems:

1. Is there an increase in the number of aircraft movements in 2043 at Djalaluddin Gorontalo Airport?
2. What is the estimated number of aircraft at peak hours in 2043 at Djalaluddin Gorontalo Airport?
3. How is the analysis of Aircraft Towing Tractor (ATT) needs in supporting Ground Handling operations in 2043 at Djalaluddin Gorontalo Airport?

In this Final Project research, the researcher provides limitations that are raised so as not to get out of the context of the title taken as follows:

1. Does not take into account the draft cost budget required to purchase the equipment.
2. Only discusses the needs of the Aircraft Towing Tractor (ATT) not other Ground Support Equipment (GSE) tools.
3. The data used for forecasting is only data from 2014 to 2018.

The objectives of this Final Project research are:

1. To determine the number of increased aircraft movements that can be served in 2043 at Djalaluddin Gorontalo Airport.
2. To determine the number of aircraft at peak hours in 2043 at Djalaluddin Gorontalo Airport.
3. To determine the need for Aircraft Towing Tractor (ATT) to support Ground Handling operations in 2043 at Djalaluddin Gorontalo Airport.

The benefits of this research are:

1. For researchers

   To add insight and experience related to Aircraft Towing Tractor (ATT).

2. For the Airport

   Adding input for the airport as needed.

3. For Academic Institutions or Campus

   Add knowledge and improve the quality of cadet research that can provide benefits.

2. METHODS

The term research method consists of two words, namely the word method and the word research. The word method comes from the Greek word methodos which means way or towards a path (Ruslan, & Rosady 2003). The method is a scientific activity related to a way of working (systematic) to understand a subject or object of research. As an effort to find answers that can be accounted for scientifically and including the language. According to the Big Indonesian Dictionary, research is an activity of collecting, processing, analyzing and presenting data carried out systematically and objectively to solve a problem or test a hypothesis to develop general principles (Department of National Education, 2001: 1163) [3],[4].

To increase the knowledge and insight of researchers, in revealing the problems that researchers raise, research methods are needed in retrieving rational, empirical and systematic data. So that by using this research method, researchers will obtain more valid data in accordance with the circumstances that occur in the field. In addition, researchers can explain the facts related to the problems raised by researchers. So that with these valid facts and data it will make it easier for researchers to analyze effective and efficient problem solving (Sugiyono, 2015)[5].

2.1 Theoretical Review

A. Aircraft Towing Tractor

An airport procedure that involves pushing an aircraft backwards out of its parking lot onto the runway. The pushback activity to push the aircraft uses the power of the pushback car, and the driver who operates it is called a pushbacker. The function of the aircraft towing tractor

or pushback car is well known, which is to pull or push the aircraft from the apron to the taxiway area.

In accordance with the SOP for the use of Aircraft Towing Tractor (ATT), which is indicated in the Decree of the Director General of Civil Aviation Number: SKEP/ 140/VI/1999, namely that in order to realize security, safety, smoothness and orderliness of traffic on the air side, requirements and procedures for vehicles that will operate on the air side are required[6].

B. Forecasting

Forecasting is a way to measure or estimate future business conditions. This measurement can be done quantitatively and qualitatively. Quantitative measurements usually use statistical and mathematical methods, namely using the semi-average trend method (semi average method), moment trend method (moment method), least square trend method (least square method) and curved line trend method or parabolic method (parabolic method). "Meanwhile, qualitative measurements usually use judgment (opinion). Sales forecasting (forecast) aims so that the forecasts made can minimize forecasting errors, meaning that the difference between reality and forecasts is not much "different" (Mulyani, S., et al. 2021: 179)[7].

C. Ground Handling

The simple definition of ground handling is ground operations or knowledge and skills about handling aircraft on the apron, handling passengers and their luggage at terminals and cargo, and post, (Abdul Majid, Suharto and Warpani, Eko Probo D, 2009).

Triyuni (as cited by Ginting 2013: 5) Ground handling is "an activity at the airport related to the service of airlines to passengers and goods / luggage at the time of departure and arrival. It also handles transit, cancel, transfer, and delay".

In Law Number 1 of 2009 concerning Aviation, article 232 paragraph 3, it is stated that one of the airport-related services is related services to support aircraft operation service activities at airports, consisting of: provision of aircraft hangars, aircraft workshops, warehousing, aircraft catering, technical services for handling aircraft on the ground (Ground handling), passenger and baggage services, as well as cargo and postal handling. Ground Handling is an airlines activity related to the handling or service of passengers and their baggage, cargo, post, aircraft ground handling equipment and the aircraft itself while at the airport both before flight departure and after flight arrival[8].

D. Ground Handling Operations

According to Sutama, operational definition is the provision or determination of meaning for a variable with the specification of activities or operations needed to measure, categorize, or manipulate variables[9].

Sugiyono (2015), the definition of operational definition in research variables is an attribute or trait or value of objects or activities that have certain variations that have been determined by researchers to study and then draw conclusions. One of the keys to successful research, in addition to careful planning, is the use of operational definitions in measuring the concepts and variables we study or the terms we use in our research documents.

In practice, the Aircraft Towing Tractor (ATT) is usually operated by Ground Handling personnel. After the aircraft arrives at the parking lot or gate, the Ground Handling officer will assist the pilot in the engine shut down process and connect the Aircraft Towing Tractor (ATT) arm or stinger to the nose of the aircraft. Then, the Aircraft Towing Tractor (ATT) will push the aircraft from the parking lot to the runway. The aircraft push back process requires good coordination between the pilot and the Ground Handling officer. In addition, the Ground Handling officer in charge of operating the Aircarft Towing Tractor (ATT) must have adequate skills and experience in operating the vehicle. All these steps are important to ensure flight safety and airport operational efficiency.

Ground Handling is part of airport operations related to ground services and activities for aircraft. Ground Handling covers a wide range of activities, from parking, loading/unloading passengers and cargo, refueling, aircraft safety checks, to cleaning the aircraft. Ground Handling is very important in airport operations because it plays a role in ensuring flight safety, passenger comfort, and operational efficiency.

E. Ground Support Equipment

Based on the Directorate General of Civil Aviation Regulation SKEP/91/IV/2008 on Ground Support Equipment (GSE), the definition of Ground Support Equipment (GSE) is a tool that is prepared for the needs of aircraft on the ground during arrival and/or departure, loading and/or unloading of passengers, cargo, and post[10].

Based on Law Number 1 Year 2009 article 222, every airport personnel directly related to the operation and/or maintenance of airport facilities must have a valid license. This is also explained in the regulation below, namely KP/041/2017 concerning Operational Technical Guidelines for Civil Aviation Safety Regulations

(CASR-139) regulating the License of Airport Personnel, that every personnel in the aviation sector must have a License or Competency Certification issued by the Minister / Ministry of Transportation through the Directorate of Airports (DBU) according to the applicable rating including all those who operate Ground Support Equipment (GSE)[11].

2.2 Research Design

Several stages of the research will be carried out in the order depicted in the flowchart shown in Figure 1.

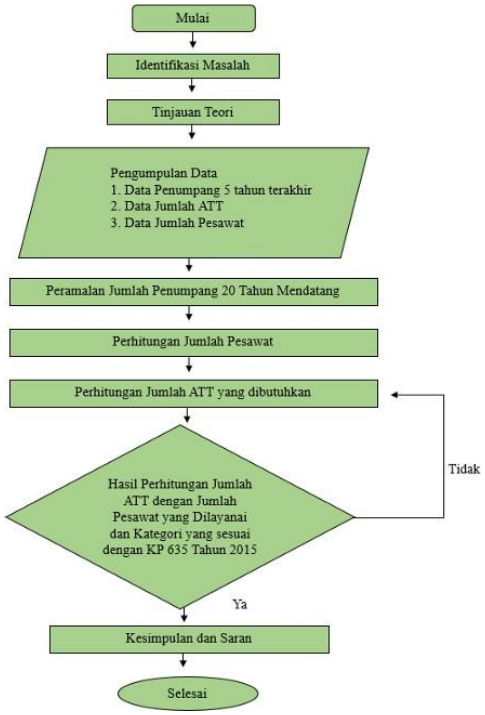

Figure 1 Research Flow Chart

The object under study is the Aircraft Towing Tractor (ATT) needed by Djalaluddin Gorontalo Airport in 2043, because for now the unit can still be said to be less than the existing standards. The number of Aircraft Towing Tractor (ATT) needs depends on the number of passengers that will exist according to the forecasting used according to the simple linear regression method.

Figure 2 Aircraft Towing Tractor

Data collection is done by collecting data from the Central Bureau of Statistics which is used to analyze the number of passengers at Djalaluddin Gorontalo Airport. The data taken is the last 5 years of passenger data (2014-2018) which will be used to find forecasts of the number of passengers to come.

In this study, the Microsoft Excel program was used to enter the data obtained and used for simple linear regression calculations. And also SPSS software is used as a statistical inference tool to determine the effect of an independent variable (Independent) on the dependent variable (Dependent). According to Sugiyono (2015: 61) the dependent variable is a variable that is influenced or becomes the result, because of the independent variable and the independent variable is a variable that affects or causes changes or the emergence of the dependent variable.

Data collection methods are the most important part of the research design, because once the title of the research design has been approved for study, the researcher can start collecting data. Relevant information is extracted and recorded on information cards. In addition to searching for information from the literature, the researcher can also start going to the field. The information recorded on the information card or going directly to the field is one of the so-called data collection techniques (Dwiloka, Bambang, & Rati Riana, 2005: 23)[12].

Arikunto (2013) explains that “data processing and data analysis have different meanings, but are often used interchangeably”. Data processing is changing raw data into more meaningful data. For example, data obtained from a questionnaire will not be meaningful if it is not analyzed[13].

The research method used is the simple linear regression research method. The simple linear regression method is a statistical method that serves to test the extent of the causal relationship between the causal factor variable (X) and the effect variable. The causal factor is generally denoted by X or also called the Predictor while the effect variable is denoted by Y or also called the Response. In analyzing the data, the forecasting method is used. The presentation of data from this study is shown through a graph of the increase in the number of passengers at Class 1 Djalaluddin Gorontalo Airport. In addition, the data presented must be simple and clear so that it is easy to understand and read.

At present the Aircraft Towing Tractor (ATT) serving or operating at Class 1 Djalaluddin Gorontalo Airport is two units. This ATT serves four commercial flights. This ATT is operated by two different ground handling parties, namely PT Arkana Dirga Indonesia and PT Langgang Buana Perkasa. And also often there is a concurrent flight or also called clash handling and there has also been damage to one ATT so that the services performed by ATT are less than optimal. ATT addition plan with structured and precise calculations for the coming year. This is also done to achieve the desired conditions and minimize delays that affect the airline's ground time.

Table 1 Passenger Growth in 2014-2018

No	Tahun	Penumpang Domestik (Orang)		Jumlah	Pertumbuhan (%)
		Datang	Berangkat		
1	2014	201950	202451	404401	
2	2015	240024	242500	482524	19.31%
3	2016	285410	288011	573421	18.83%
4	2017	331466	332787	664253	15.84%
5	2018	346220	327925	674145	1.48%
Peningkatan rata-rata					13.86%

After the process of analyzing the passenger data obtained, the data obtained will be entered into a simple linear regression formula. From these calculations, we will find a forecast of the number of passengers which will be used to find fleet or aircraft requirements.

3. RESULT AND DISCUSSION

This study uses a simple linear regression method which is searched with 2 (two) software, namely SPSS Software and Microsoft Excel program to find the results of forecasting the number of passengers, fleet or aircraft requirements, and Aircraft Towing Tractor (ATT) requirements.

From the data on the number of passengers that have been obtained in 2014-2018, the data is then processed to estimate the number of passengers for the next 20 years with an estimated time of 2024-2043. So that from the estimated number of passengers obtained, busy time passenger data will be determined which is useful for knowing the needs of the fleet or aircraft.

Table 2 Predicted Passenger Count Result

PREDIKSI JUMLAH PENUMPANG				
Tahun	a	b	X	Y=a+bX
2024	343.384	72.122	11	1.136.726
2025	343.384	72.122	12	1.208.848
2026	343.384	72.122	13	1.280.970
2027	343.384	72.122	14	1.353.092
2028	343.384	72.122	15	1.425.214
2029	343.384	72.122	16	1.497.336
2030	343.384	72.122	17	1.569.458
2031	343.384	72.122	18	1.641.580
2032	343.384	72.122	19	1.713.702
2033	343.384	72.122	20	1.785.824
2034	343.384	72.122	21	1.857.946
2035	343.384	72.122	22	1.930.068
2036	343.384	72.122	23	2..002.190
2037	343.384	72.122	24	2.074.312
2038	343.384	72.122	25	2.146.434
2039	343.384	72.122	26	2.218.556
2040	343.384	72.122	27	2.290.678
2041	343.384	72.122	28	2.362.800
2042	343.384	72.122	29	2.434.922
2043	343.384	72.122	30	2.507.044

Table 2 shows the number of passengers increasing every year, it will affect the need for Aircraft Towing Tractor (ATT). Regulation of the Minister of Transportation of the Republic of Indonesia Number 178 of 2015 concerning Airport Service User Service Standards is used as a reference in forecasting Busy Time Passengers (PWS) in 2019-2043 [14].

Table 3 Busy Time Passengers Penumpang Waktu Sibuk (PWS)

Jumlah Penumpang per tahun (Juta)	Koefisien (%)
>30	0,035
20 - 29,999	0,040
10 - 19,999	0,045
1 - 9,999	0,050
0,5 - 0,999	0,80
0,1 - 0,4999	0,130
<0,1	0,2

Furthermore, to find out the calculation of peak time passengers in 2019-2043, of course, refers to the coefficient obtained from Table 3 which is then accumulated into the following formula.

$$\frac{(Number\ of\ Passengers/Year) \times (koef\ PWS)}{100}$$

Table 4 Forecasting Busy Time Passengers (PWS)

PERAMALAN PENUMPANG WAKTU SIBUK			
Tahun	Jumlah Penumpang	Koefisien (%)	PWS
2024	1136726	0.08	909
2025	1208848	0.08	967
2026	1280970	0.08	1025
2027	1353092	0.08	1082
2028	1425214	0.08	1140
2029	1497336	0.08	1198
2030	1569458	0.08	1256
2031	1641580	0.08	1313
2032	1713702	0.08	1371
2033	1785824	0.08	1429
2034	1857946	0.08	1486
2035	1930068	0.08	1544
2036	2002190	0.08	1602
2037	2074312	0.08	1659
2038	2146434	0.08	1717
2039	2218556	0.08	1775
2040	2290678	0.08	1833
2041	2362800	0.08	1890
2042	2434922	0.08	1948
2043	2507044	0.08	2006

From the results of the busy time passengers can be used to determine the passenger carrying capacity of the aircraft. In analyzing passenger carrying capacity we need Load Factor on each aircraft operating at Djalaluddin Gorontalo Airport.

In calculating the total passenger capacity of the aircraft, a Load Factor of only 65% is used because if the Seat Load Factor is less than 65%, the operating airline will experience losses (Wicaksana, D, A., Ricardianto, p., & Harahap, V, N., 2020) [15].

$$LF = Number\ of\ Aircraft\ Seats \times 65\%$$

a. A320

LF = 156 × 65% = 101,4 = 101

b. B 737-800

LF = 168 × 65% = 109,2 = 109

c. B 737-900

LF = 215 × 655 = 139,75 = 140

d. TWIN OTTER

LF = 20 × 65% = 13

e. ATR-72

LF = 72 × 65% = 46,8 = 47

Table 5 Passenger carrying capacity

KAPASTITAS ANGKUT PENUMPANG						
Tahun	A320	B737-800	B737-900	OTTER	ATR	Jumlah Kapasitas Angkut Penumpang
	LF = 65%	LF = 65%	LF = 65%	LF = 65%	LF = 65%	
2024	202	327	280	39	188	1036
2025	202	327	420	39	188	1176
2026	202	327	420	39	235	1223
2027	202	436	420	39	235	1332
2028	202	436	420	52	235	1345
2029	202	436	420	52	282	1392
2030	303	436	420	52	282	1493
2031	303	545	420	52	282	1602
2032	303	545	560	52	282	1742
2033	303	545	560	65	282	1755
2034	303	545	560	65	329	1802
2035	303	545	560	65	329	1802
2036	303	545	560	78	329	1815
2037	404	545	560	78	376	1963
2038	404	545	560	91	376	1976
2039	404	545	560	91	376	1976
2040	404	654	560	91	376	2085
2041	404	654	700	91	376	2225
2042	404	654	700	104	376	2238
2043	404	654	700	104	423	2285

In calculating the needs of the aircraft fleet we must calculate the movement of aircraft both take off and landing which refers to the passenger carrying capacity.

Table 6 Fleet Needs

Tahun	KEBUTUHAN ARMADA					Pesawat Jam Sibuk	Penumpang Harian	
	Frekuensi (LF=65%)						Harian	Jam Sibuk
	A320	B737-800	B737-900	TWIN OTTER	ATR-72		Penumpang/ Hari	Penumpang/ Waktu Jam Sibuk
	(156 Seat)	(168 Seat)	(215 Seat)	(20 Seat)	(72 Seat)			
	LF = 65%	LF = 65%	LF = 65%	LF = 65%	LF = 65%			
2024	2	1	1	2	2	8	3114	909
2025	2	1	1	2	2	8	3312	967
2026	2	1	1	2	2	8	3510	1025
2027	2	2	1	2	2	9	3707	1082
2028	2	2	1	2	2	9	3905	1140
2029	2	2	1	2	3	10	4102	1198
2030	2	2	1	2	3	10	4300	1256
2031	2	3	1	2	3	11	4497	1313
2032	2	3	2	2	3	12	4695	1371
2033	2	3	2	3	3	13	4893	1429
2034	2	3	2	3	4	14	5090	1486
2035	2	3	2	3	4	14	5288	1544
2036	2	3	2	3	4	14	5485	1602
2037	3	3	2	3	4	15	5683	1659
2038	3	3	2	3	4	15	5881	1717
2039	3	3	2	3	4	15	6078	1775
2040	3	3	2	3	4	15	6276	1833
2041	3	3	3	3	4	16	6473	1890
2042	3	3	3	4	4	17	6671	1948
2043	3	3	3	4	5	18	6869	2006
2044	3	3	3	4	5	18	7066	2063
2045	3	3	3	5	5	19	7264	2121

In calculating the need for Aircraft Towing Tractor (ATT) requires supporting data in the form of aircraft fleet requirements. Based on Table 6, it can be seen that in 2043 the estimated aircraft fleet operating at Djalalaluddin Gorontalo Airport. The data is then used in calculating the number of Aircraft Towing Tractor (ATT) needed. In accordance with the Directorate General of Civil Aviation Regulation SKEP 47/III/2007 concerning Guidelines for the Implementation of Airport Support Activities Business based on the standard calculation of Ground Support Equipment (GSE) at Djalaluddin Gorontalo Airport. So it is needed for each aircraft served by 1 (one) Aircraft Towing Tractor (ATT) [16].

Table 7 Aircraft Towing Tractor (ATT) Requirement

TAHUN	KEBUTUHAN AIRCRAFT TOWING TRACTOR		
	A320	B737-800	B737-900
2024 - 2026	2	1	1
2017 - 2030	2	2	1
2031	2	3	1
2032 - 2036	2	3	2
2037 - 2040	3	3	2
2041 - 2043	3	3	3

Based on the results of the Aircraft Towing Tractor (ATT) calculation analysis, it can be concluded in Table 7 that in 2043 Djalaluddin Gorontalo Airport requires 9 units of Aircraft Towing Tractor (ATT) to support Ground Handling operational activities.

4. CONCLUDING

4.1 Conclusion

Based on the results of the analysis of Aircraft Towing Tractor (ATT) needs in the next 2043 at Djalaluddin Gorontalo Airport, it can be concluded that:

1. Based on the analysis studied the results of the calculation of aircraft movements from 2024-2043 there was an increase in the number of passengers which affected the increase in aircraft movements at Djalaluddin Gorontalo Airport.
2. The results of the calculation analysis of the number of aircraft at peak hours in 2043 at Djalaluddin Gorontalo Airport, estimated to be 3 (three) A320 aircraft, 3 (three) B737-800 aircraft, 3 (three) B737-900 aircraft, 5 (five) TWIN OTTER aircraft, 5 (five) ATR-72 aircraft.
3. The results of the analysis of Aircraft Towing Tractor (ATT) needs in 2043 show that additional Aircraft Towing Tractor (ATT) units are needed to support the number of passengers and Ground Handling operational activities. In 2043 at Djalaluddin Gorontalo Airport using simple linear regression calculations, 9 units are needed to support operations.

4.2 Advice

The suggestions that can be given regarding the results of research for development steps are as follows:

1. It is necessary to replace the existing Aircraft Towing Tractor (ATT) unit because the unit is not feasible and does not comply with PM 91 of 2016.
2. Adding Aircraft Towing Tractor (ATT) units to optimize ground handling operations and also need a backup unit to anticipate damage to existing units.

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