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Relayout of Parking Stand Arrangement at Sultan Babullah Ternate Airport

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Abstract:- Sultan Babullah Ternate Airport features 8 parking stand capacities and serves as a strategic airport, acting as the primary gateway for domestic flights to North Maluku Province. All domestic flights from outside North Maluku arrive at Sultan Babullah Ternate Airport. This has led to a significant increase in aircraft movements, air traffic, and the demand for aircraft parking areas. The objective of this study is to optimize the number of parking stands at Sultan Babullah Ternate Airport, assess apron capacity, and provide recommendations for improving aircraft parking facilities. A qualitative approach is used, involving field observations, in-depth interviews, and the collection of relevant documents. The findings suggest that a strategically redesigned apron layout could increase capacity from the current 8 to 9 parking stands. The expansion will utilize available apron space, prioritizing Cessna 208-type aircraft and other small aircraft. This solution aims to accommodate the growing airport operations while ensuring flight safety. Furthermore, this optimization is expected to strengthen the strategic role of Sultan Babullah Ternate Airport as the primary air transportation hub in eastern Indonesia.

Keywords:- *Airport , Apron, Parking Stand, Relayout.*

I. INTRODUCTION

The aviation sector in Indonesia is steadily expanding due to increasing passenger demand. Sultan Babullah Ternate Airport is among those experiencing significant growth, and it is operated by the Airport Operator Unit (UPBU).

According to Annex 14 by the International Civil Aviation Organization (ICAO), an airport is a designated area on land or water (including buildings, facilities, and equipment) allocated, either entirely or partially, for the arrival, departure, and movement of aircraft.

Law No. 1 of 2009 concerning Aviation defines an airport as a designated area on land and/or water, marked by specific boundaries, used for aircraft landings and takeoffs, passenger boarding, and the loading and unloading of goods. It also serves as a hub for transfers between different modes of transportation and is equipped with essential flight safety and security features, along with primary and supporting facilities. Airports comprise two types of facilities: landside and airside facilities.

- *Landside Facilities refer to the infrastructure and services available for passengers, goods, and vehicles prior to entering the security zone. These facilities encompass:*

- Passenger Terminal: Check-in counters, security screening, waiting lounges, and additional general amenities.
- Vehicle Parking Zone: Accommodates private vehicles, taxis, and other public transportation.
- Logistics Facilities: Areas designated for the storage and handling of cargo and goods.

- *Airside Facilities are the primary structures that support aircraft flight operations in requiring special permits. These facilities include:*

- Runway: A designated area for aircraft to takeoff and landing.
- Taxiway: The pathway linking the runway and the apron.
- Apron: A designated area for aircraft parking, enabling the boarding and disembarking of passengers, as well as the maintenance of light aircraft.
- Navigation and Air Safety: Includes Air Traffic Control (ATC) towers, navigation aids, and radar systems.

Sultan Babullah Ternate Airport serves as the primary gateway for domestic flight routes to North Maluku Province. As a result, the volume of aircraft movements on the apron continues to increase.

According to Regulation No. KP 39 of 2015 by the Directorate General of Air Transportation regarding Technical Standards and Operations of Civil Aviation Safety Regulations, an apron is a designated area at an airport where aircraft are accommodated for boarding and disembarking passengers, loading and unloading cargo and mail, refueling, parking, or maintenance.

An important consideration at Sultan Babullah Ternate Airport is the configuration of aircraft parking stands. A parking stand is a specific area within the apron zone allocated for aircraft parking, including overnight parking (RON) or grounding. The airport currently has 8 parking stands, numbered 1, 1A, 2, 3, 4, 5, 6, 7, and 8, with stand H designated as the helicopter landing pad (helipad). Stands 7 and 8 are specifically assigned for aircraft using the Aviobridge.

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The primary users of the Aviobridge are aircraft from the B737 series and the Airbus A320. The characteristics of these aircraft are crucial for runway planning, as their classification and specifications directly impact runway length, pavement thickness, and planning techniques. Designing and planning an airfield requires a thorough understanding of the general characteristics of aircraft to effectively plan its infrastructure.

During peak hours, the capacity of the apron and runway limits the number of aircraft that can park or depart. As a result, aircraft often have to hold in the air before landing, which not only delays passengers but also increases costs for airlines.

With the growing volume of air traffic and the increasing variety of aircraft in operation, the current layout is considered suboptimal for supporting aircraft operations. Modifications to operational policies may necessitate the reconfiguration or redesign of aircraft parking areas.

Frederick Winslow Taylor argues that relayout is a critical component of efforts to improve productivity and efficiency, serving as a method to optimize resource use and reduce waste.

II. RESEARCH METHODS

The study was conducted from August to December 2023 at Sultan Babullah Ternate Airport. This research is classified as qualitative, aiming to understand the phenomena experienced by the research subjects, including their behavior, perceptions, motivations, actions, and more. The study utilizes two categories of data: primary and secondary data.

- Primary data consists of information collected directly by the researchers through interviews with AMC personnel using structured questions and direct observation. The interviews involve three informants: the Head of the AMC Unit, the Supervisor of the Aerodrome Control Tower, and the Ground Handling representative. Additionally, the findings are based on observations made collaboratively in the field with AMC personnel.
- Secondary data refers to information previously collected by other entities, including scientific publications, books containing researched material, and relevant research findings. In this study, secondary data includes documents related to parking lot planning.

➢ *Data Collection in this Study was carried out in Multiple Stages, Specifically:*

- *Observation Methods*

The research involved directly visiting the site, Sultan Babullah Ternate Airport, to conduct observations.

- *Interview*

The interview with the first informant, Mr. Jamaludin Larusli, Head of the AMC Unit, took place on Monday, December 4, 2023, at Sultan Babullah Ternate Airport. The second interview, with Tower Officer Mr. Pri, took place on Tuesday, December 5, 2023, at the Airnaf Ternate branch office. The third interview, with Mr. Hayatudin Idrus Yusuf, Airside Operations Staff of the AMC unit, was conducted on Wednesday, December 6, 2023, in the AMC room at Sultan Babullah Ternate Airport.

- *Observation Methods*

The documentation to be presented will include AMC documents and photographs taken during the activity.

III. RESULTS AND DISCUSSION

➢ *Traffic Data*

The air traffic data used covers the past seven years, specifically from 2017 to 2023. Data from 2019 shows a decline due to the COVID-19 pandemic, which led to a temporary suspension of transportation modes at the end of the year, affecting both aircraft and passenger movements. Information on aircraft and passenger movement from 2017 to 2019 is presented in Figure 1 and Table 1.

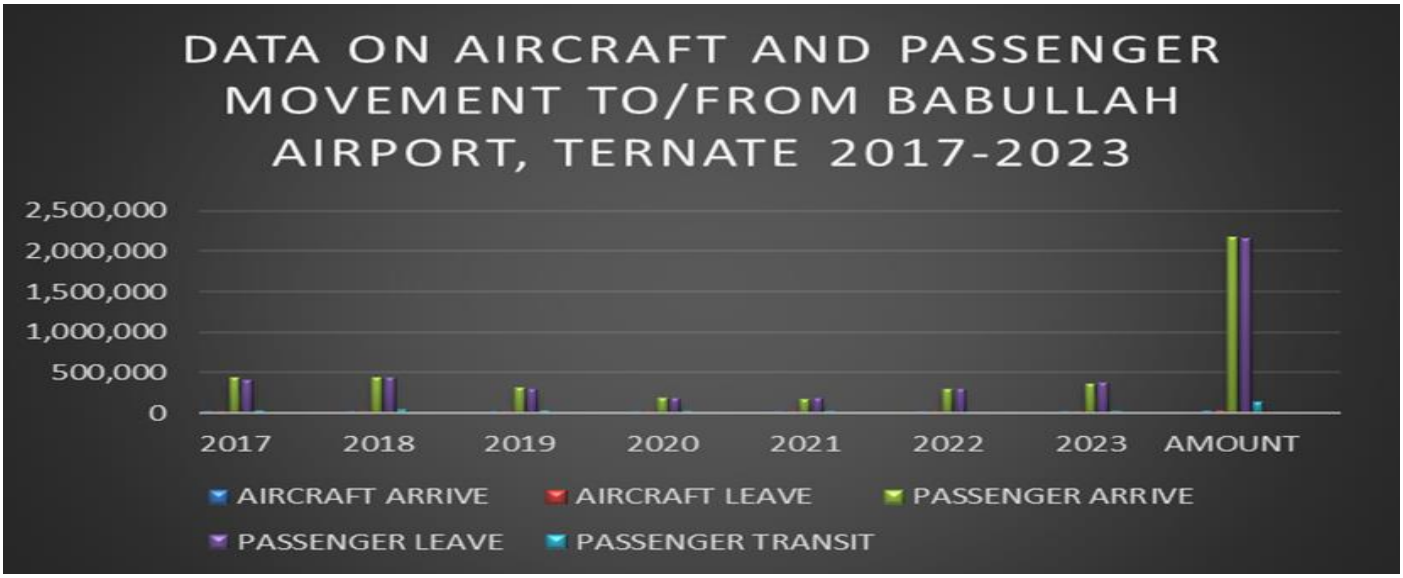

Fig 1 Chart of Traffic Comparison Data 2017-2023

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Table 1 Aircraft Movements from 2017-2023

NO	YEAR	AIRCRAFT		PASSENGER		
		ARRIVE	LEAVE	ARRIVE	LEAVE	TRANSIT
1	2017	5,696	5,696	430,702	404,130	26,077
2	2018	5,773	5,773	434,972	435,136	41,379
3	2019	4,523	4,523	310,668	294,741	30,551
4	2020	2,520	2,520	181,770	174,661	19,846
5	2021	2,768	2,768	171,212	178,485	7,278
6	2022	3,436	3,438	284,440	297,633	0
7	2023	4,227	4,237	362,041	369,964	7,536
	AMOUNT	28,943	28,955	2,175,805	2,154,750	132,667

➢ *Parking Space Availability and Utilization*

According to Table IV.4, Sultan Babullah Ternate Airport has 8 parking stands. The parking stands currently in use are stands 1, 3, 4, 5, 6, 7, and 8. Stand 2 is rarely used for aircraft parking, as its dimensions are designed specifically for small-body aircraft. Additionally, when narrow-body aircraft are parked, stands 1 and 2 cannot be used simultaneously by aircraft that match their intended specifications. During the 16 operational hours allocated for parking, there are typically 2 to 3 aircraft occupying the parking stands each hour.

Table 2 Vehicle Accumulation

Parking stand	06.00 - 06.59	07.00 - 07.59	08.00 - 08.59	09.00 - 09.59	10.00 - 10.59	11.00 - 11.59	12.00 - 12.59	13.00 - 13.59	14.00 - 14.59	15.00 - 15.59	17.00 - 17.59	18.00 - 18.59	19.00 - 19.59	20.00 - 20.59
1	1							1						
2														
3									1				1	
4									1					
5			1		1							1		
6			1											
7	1		1			1		1				1		
8	1			1		1	1		1		1			

This information suggests that only 5 parking stands are available for use. When 2 planes land in the next hour, stands 5 to 8 will be fully occupied, while the other parking stands will be prepared for when the planes are grounded.

➢ *Apron Analysis and Aircraft Type*

Sultan Babullah Ternate Airport is classified as a domestic Class II UPBU Airport, with 8 parking stands. These stands accommodate various aircraft, including mixed types such as the B738, A320, and Boeing Classic series, as well as combinations with models like the CRJ1, ATR 72, ATR 42, C208, and similar aircraft, which utilize parking stand 1A. The current status of the parking stands is shown in Table 2 and Figure 3.

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Table 3 Existing Parking Stand

	1	1A	2	3	4	5	6	7	8	HELIPAD
PS	ATR 42	C208	B738	Boeing Classic Series	ATR 72	ATR 72	B738	B738	B738	Helicopter
	C208		A320	CRJ1	ATR 42	ATR 42	A320	A320	A320	
			Boeing Classic Series	ATR72	C208	C208	Boeing Classic Series	Boeing Classic Series	Boeing Classic Series	

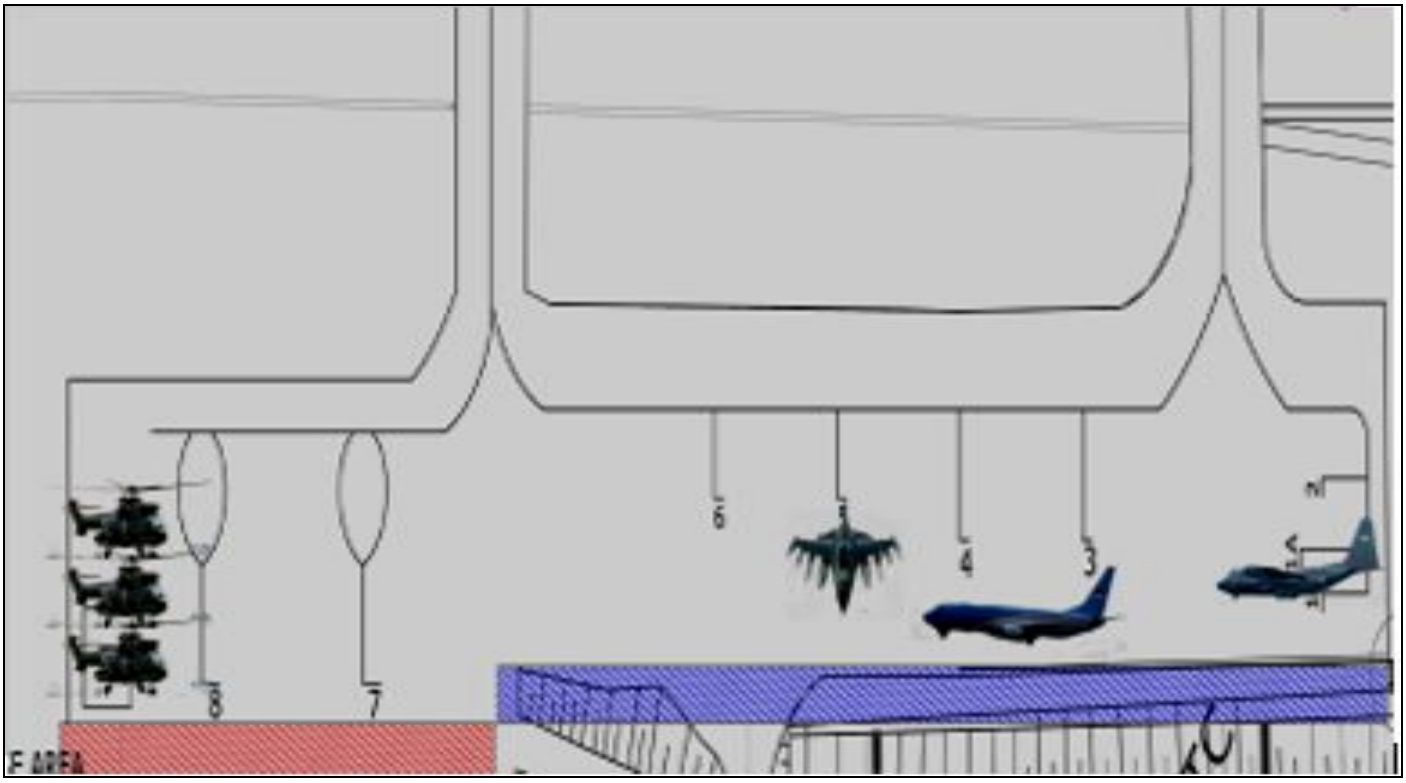

Fig 2 Layout Apron Exixting

From the explanation provided, it is evident that the allocation of aircraft parking stands is tailored according to the specified type of aircraft. To enhance the utilization of the apron and its facilities, it is essential to adopt a flexible approach, allowing both wide-bodied and smaller aircraft to share the available resources effectively.

Parking stands 1 and 2 can accommodate ATR72 and C208 aircraft simultaneously. However, if an aircraft type that does not correspond with its designated stand, such as a B737, is parked at stand 1A, only one aircraft can be accommodated at parking stands 1 and 2 due to apron capacity limitations. This leads to suboptimal use of the parking stands.

- *Parking Stand Arrangement Relayout Analysis*

Based on the data analysis above, a proposed design was developed to maximize the capacity of the parking stands while considering the safe distance between aircraft. The initial layout is shown in Figure 2.

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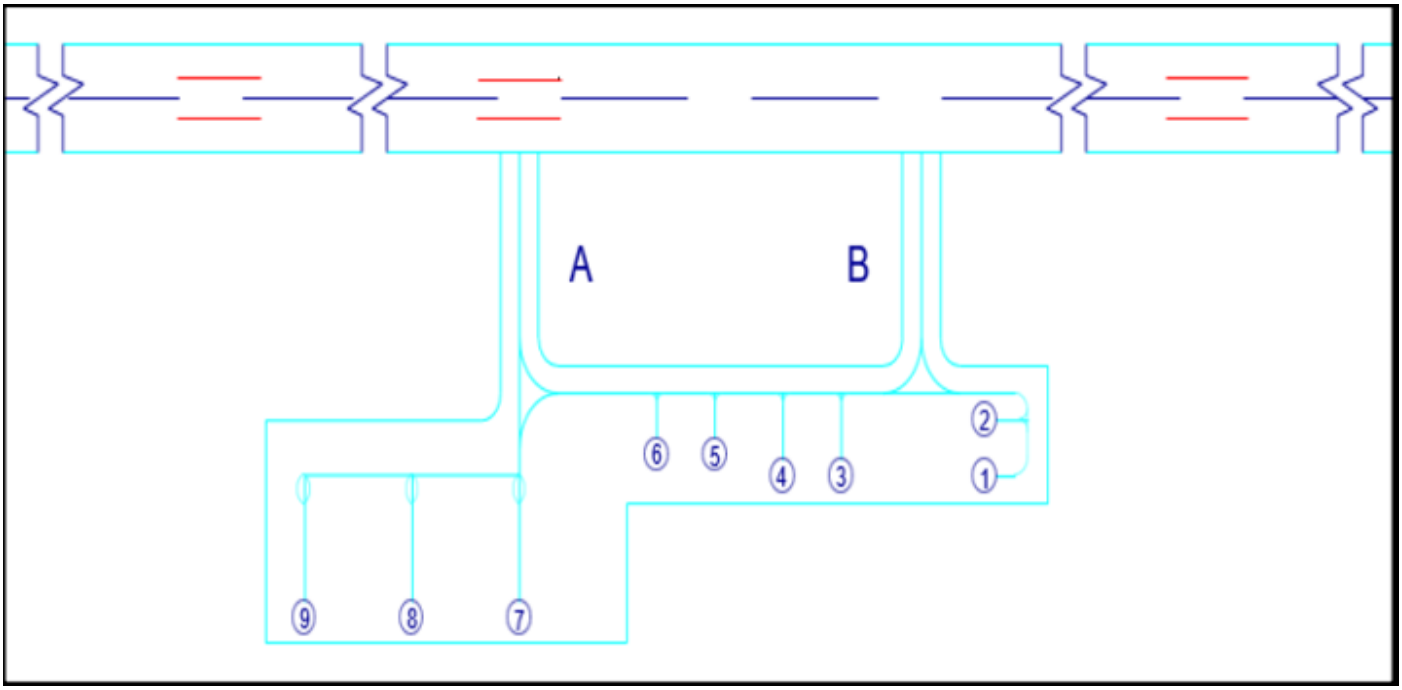

Fig 3 Suggested Arrangement

In Figure 3, the parking layout design has been revised from 8 to 9 parking stands. Stand 8 is designated for small aircraft, such as the Cessna, Piper PA-28, and similar models, while stands 7 and 9 are allocated for narrow-body aircraft. Aircraft utilizing the aerobridge facility are given priority to park at stands 7 and 9.

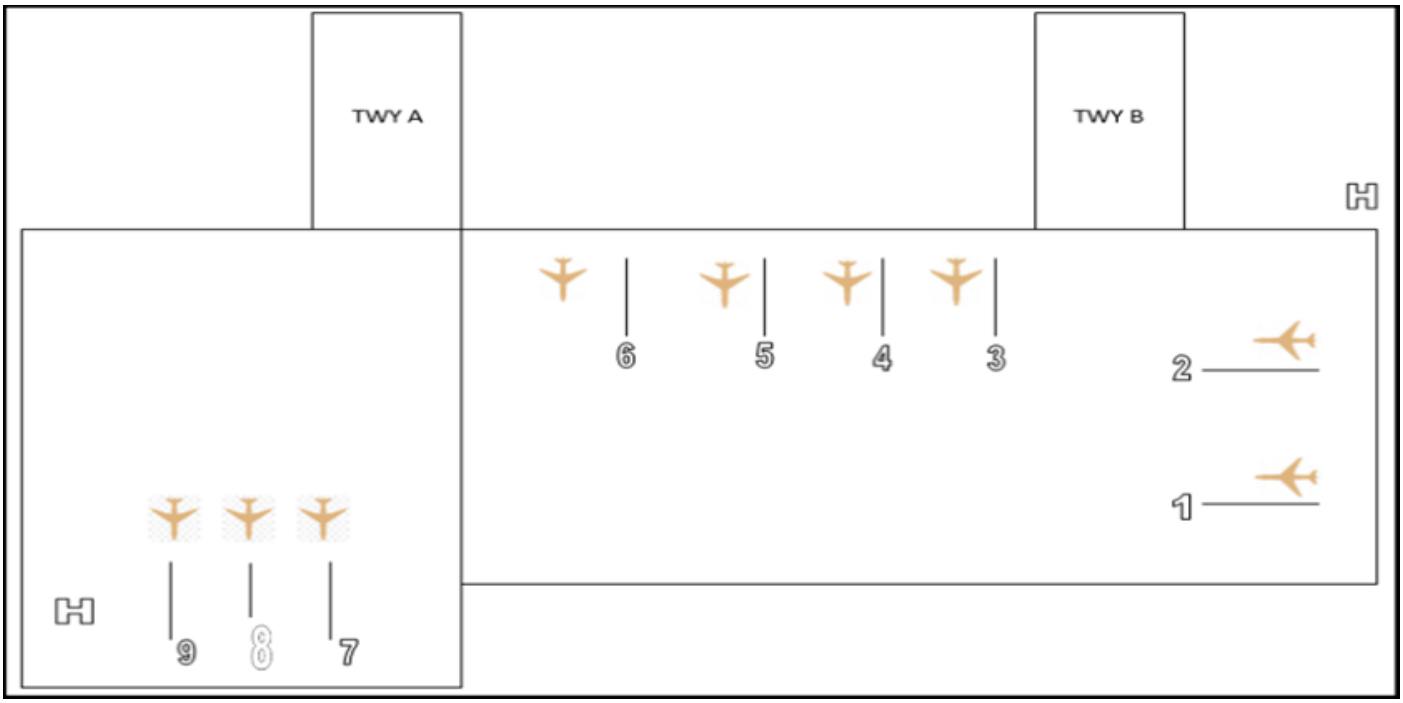

Fig 4 Depiction of Aircraft Parking

The proposed relayout aims to enhance apron capacity by introducing nine additional efficient and organized parking stands. Calculations of the main apron area revealed significant free space between parking stands 7 and 8. By optimally utilizing this space, aircraft parking capacity can be maximized without compromising safety or operational efficiency. The analysis is evaluated against standards established by the Federal Aviation Administration (FAA) and the International Civil Aviation Organization (ICAO). A key consideration in the proposed configuration is ensuring that the wingtip clearance meets safety standards. For aircraft parking in this area, the minimum distance between the aircraft's wingtip and any fixed obstruction must be 12 meters. Furthermore, the minimum clearance between the wingtips of aircraft parked in adjacent stands is regulated to ensure safety and smooth operations. This provision is intended to maintain safe spacing between aircraft, prevent potential incidents, and facilitate effective air traffic management.

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Table 4 Wingtip Clearance

Code Letter	Ukuran *Wingspan*	Clearence
A	> 15 m	3 m
B	15 m > L > 24 m	3 m
C	24 m >L > 36 m	4,5 m
D	36 m > L > 52m	7,5 m
E	52 m > L > 60 m	7,5 m

Table 5 Types of Aircraft According to ICAO

Code Number ICAO	Code Letter ICAO	Aircraft
1	A	All single-engine aircraft
2	B	EMB-120,Sabb 2000,Saab 30
3	C	B727,B737,MD-80,A320
4	D	Boeing 757,A300,B767
5	E	Boeing 747,A340,A330,A350,B777
6	F	Airbus A380

The apron area between parking stands 7 and 8 measures 180 x 90 m² and is designed to accommodate two Boeing 737 series and A320 aircraft. Both the Boeing 737 and Airbus A320 fall under Code Letter C, which requires a wingtip clearance of 4.5 meters. The wingspan of the Boeing 737-800 is 33 meters, while the Airbus A320 has a wingspan of 34 meters. For two aircraft, the total wingspan is calculated as 2 x (33 + 34) = 134 meters. Adding the required wingtip clearance of 4.5 meters for each aircraft (4.5 x 2 = 9 meters), the total apron space utilized is 143 meters. This leaves a remaining space of 37 meters from the total apron length of 180 meters. This available space will be used to rearrange the parking stands, increasing the total from 8 to 9, as shown in Figure 4.

IV. CONCLUSION

After completing the text editing, the paper is ready to be formatted using the template. Duplicate the template file by using the "Save As" command and apply the naming convention specified by your conference. In the new file, highlight all the content and import your prepared text. You are now ready to style your paper; use the dropdown menu on the left side of the MS Word Formatting toolbar.

The findings of this study reveal that the parking stands at Sultan Babullah Ternate Airport are currently suboptimal, indicating the need for a relayout to improve efficiency. Following the relayout, the number of parking stands increased from 8 to 9, with the additional stand designated for Cessna 208 aircraft and other small aircraft types. This increase in parking stands is expected to improve the airport's operations and provide a basis for sustainable development at Sultan Babullah Airport.

REFERENCES

[1]. Afriani Nur Ryski Suci, Suryan Viktor (2022). Analisa Metode FAA dan ICAOLCN pada Perencanaan Perkerasan Runway di Bandar Udara Silampari Lubuklinggau, Jurnal Talenta Sipil, Vol.5, No.1, 158-164

[2]. Amendment 114 for AIP INDONESIA, 24 FEB 22

[3]. Amendment 126 for AIP INDONESIA, 23 FEB 23

[4]. Boeing, 2013. 737 Airplane Characterictics for Airport Planning. - ed. America: Boeing Commercial Airplanes.

[5]. Buku Panduan Kuliah Praktek Kerja (KPK), Prodi S1 Manajemen Transportasi Udara (MTU). STIE IEU Yogyakarta. (2023)

[6]. FAA., 2016. Advisory Circular (AC) No: 150/5320-6F, Airport Pavement Design and Evaluation. ed. America: U.S. Departement of Transportation

[7]. Herri Purwanto, A. S., 2019. Analisa Perencanaan Runway, Taxiway, dan Apron Pada Bandara Sultan Mahmud Badaruddin II Palembang Menggunakan Metode FAA (Federal Aviation Administration). Deformasi, 4(1), pp. 21-30.

[8]. ICAO. (1987). Airport Planning Manual Part 1 Master Planning, International Civil Aviation Organization, Second Edition 1987 Doc 9184-AN/902.

[9]. ICAO. (2013). Annex 14 Aerodrome Volume 1 Aerodrome Design and Operations, International Civil Aviation Organization, Sixth Edition July 2013.

[10]. Kemenhub. 2015. Perturan Direktur Jenderal Perhubungan Udara KP Nomor 94 Tahun 2015 Tentang Pedoman Operasional Peraturan Keselamatan Penerbangan Sipil , Jakarta: Kementerian Perhubungan Republik Indonesia.

[11]. Peraturan Direktorat Jenderal Perhubungan Udara No. KP 39 Tahun 2015 tentang Standar Teknis dan Operasi Peraturan keselamatan Penerbangan Sipil

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14636419

[12]. Peraturan Direktur Jenderal Perhubungan Udara NOMOR : SKEP/77/VI/2005 Tentang Persyaratan Teknis Pengoperasian Fasilitas Teknik Bandar Udara, Jakarta.
[13]. Peraturan Menteri Perhubungan Republik Indonesia NOMOR : PM 178 Tahun 2015 Tentang Standar Pelayanan Pengguna Jasa Bandar Udara Pengertian bandar udara menurut annex 14 dari ICAO (International Civil Aviation Organization)
[14]. Standart Operational Procedure (SOP) Bandar Udara Sultan Babullah Ternate