

Analysis of the Impact of Foreign Object Debris on the Air Side for Flight Safety and Security at General Ahmad Yani International Airport Semarang

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Abstract

Airport is an area on land or water with predetermined boundaries that functions as a location for aircraft to land and take off, for people to get on and off, for loading and unloading of cargo, a place for intra and intermodal transportation, and which is equipped with basic and other supporting facilities besides facilities for aviation safety and security. This research uses a qualitative method with a descriptive research type. Researchers obtained data for this study at General Ahmad Yani International Airport, Semarang. Collecting data from this study, namely interviews, observation, and documentation. The results of this study indicate that the impact of Foreign Object Debris on the air side greatly disrupts flight activities. So that Apron Movement Control officers coordinate with stakeholders in order to handle Foreign Object Debris so as not to interfere with flight activities and create aviation safety and security.

Keywords: Foreign Object Debris (FOD), Apron Movement Control (AMC)



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INTRODUCTION

Airport is an area on land or water with predetermined boundaries that functions as a location for aircraft to land and take off, for people to get on and off, for loading and unloading of cargo, a place for intra and intermodal transportation, and which is equipped with basic facilities and other supporting facilities besides facilities for aviation safety and security. International Airport is an airport designated as an airport that handles Domestic and International flight routes. Airports that have facilities for Customs and Immigration can handle flights to and from other countries that are international in nature. International airports are often larger, often have longer runways, and have the capability to handle the large aircraft often used for intercontinental international travel.

Jenderal Ahmad Yani International Airport is located in the city of Semarang, 5 km from the city of Semarang. General Ahmad Yani International Airport Semarang is one of the international airports in Indonesia and has become one of the airports with international status in Central Java. Jenderal Ahmad Yani International Airport has a terminal with an area of 58,652 m² and an apron area of 72,522 m² each of which can accommodate 13 small body aircraft or around 10 small body aircraft and 2 large body cargo aircraft. The airport area is divided into 2, namely Airside and Landside. Landside (land side) is an area at the airport which is the outside of the terminal building which is free to the public (public area) and inside the terminal building which is restricted to the public (restricted public area). Meanwhile, the airside/airside is part of the airport and all its supporting facilities which describe a closed area where each person, baggage and means of transport who wish to enter the area must go through security checks and have special approval. The airside/airside is an area that starts

from the apron gate, taxiway and runway which is a hidden area or not for the public (non-public area).

In the airside area there are several units, one of which is the Apron Movement Control Unit (AMC). Jenderal Ahmad Yani Semarang International Airport is home to the AMC Unit, which is tasked with maintaining order and cleanliness in the airside area and overseeing aircraft movements and documenting flight data, as well as ensuring the safety and smooth running of vehicles. Supervision is carried out, namely monitoring the movement of aircraft departing (take off) and arriving (landing), the movement of aircraft departing and entering (landing), as well as aircraft from the runway to the parking lot or vice versa which are propelled by engines or by push back cars or crane tractors, the Apron Movement Control (AMC) is a unit that has an important function in determining where the aircraft will park.

Along with the many activities on the air side or apron, it causes foreign objects (Foreign Object Debris) in the air side area. According to the 2019 Ministry of Transportation, Foreign Object Debris (FOD) is a foreign object on the air side (apron, taxiway and runway) that can cause damage to aircraft during takeoff and landing. There are many FODs in the airside area, therefore the airside area must always be clean and sterile from foreign objects that can cause damage to the structure and performance of an aircraft and ultimately disrupt the safety and security of a flight. Types of FOD that can pose a risk and can endanger the safety of flights operating at Ahmad Yani Airport at this time including the many wild animals such as birds, snakes, monitor lizards, lizards and other foreign objects such as kites, tree branches, hot air balloons. Not infrequently also on the side of the apron are often found bolts, padlocks, paper, nuts and other foreign objects. Keeping the apron clean to avoid Foreign Object Debris (FOD) is one of the main aspects in realizing flight operational safety on the air side, in order to prevent risks that could endanger aircraft. AMC officers, Aviobridge operators, and other officers working in the airside area participate in maintaining airside cleanliness. This aims to create smooth activities on the air side. Every airport implements inspections, supporting tools such as inspection cars are provided, and all operating vehicles such as ground support equipment (GSE) vehicles are required to bring a FOD storage area for the airside area, in order to provide convenience if FOD is found in the apron area.

The impact of Foreign Object Debris (FOD) has the potential to endanger aviation safety and security. Cleanliness of the apron area on the airside from foreign objects or Foreign Object Debris (FOD) such as gravel, bolts, and remnants of Ground Handling activities can cause flight delays because the runway and parking area are not clean so if the foreign object is sucked into the aircraft engine, it will seriously threaten the safety and security of passengers and aircraft cabin crew, therefore the area on the airside must be as clean and optimal as possible from the presence of foreign objects or Foreign Object Debris (FOD).

Research Objectives: to determine the impact of Foreign Object Debris (FOD) on the air side for aviation safety and security at Jenderal Ahmad Yani International Airport Semarang. To find out how Foreign Object Debris is handled by Apron Movement Control unit officers at General Ahmad Yani International Airport in Semarang as an effort to prevent the risk of threats to aviation safety and security.

Theoretical Basis

Definition of Impact Analysis

Impact analysis is an observation of the major impacts that bring changes to the region. Impact analysis in foreign terms is called "environmental impact analysis", "environmental impact statement", "environmental impact assessment", or "environmental assessment and

statement". Professor Otto Soemarwoto, uses this term with an impact analysis that refers to changes in area, while Professor St. Mnadjat Danusaputro, termed "environmental impact statement". All of the above designations indicate that the notion of impact and change needs to be studied (analyzed) earlier and carefully based on this study will be able to identify the impacts that arise, both beneficial and harmful to human life (S.H.T. Siahaan, 2004).

Foreign Object Debris

Control in the airside area carried out by the Apron Movement Control (AMC) unit includes inspection of Foreign Object Debris (FOD). Foreign Object Debris (FOD) according to Regulation of the Director General of Civil Aviation Number: KP 326 of 2019 concerning Operational Technical Standards of Civil Aviation Safety Regulations-Part 139 (Manual of standard CASR- Part 139) Volume 1 Airport (Aerodrome), Foreign Object Debris (FOD) is an immovable object that is in the movement area that does not have an operational or aeronautical function and has the potential to be very risky for aircraft operations. Foreign Object Debris (FOD) can directly damage aircraft, such as tearing tires, being sucked into the aircraft engine or being thrown very hard due to the pressure of the aircraft engine (jetblast) and can finally damage the aircraft engine and cause woe to people.

One of the big problems in the aviation maintenance industry is damage caused by foreign goods (FOD), which can affect the safety of aircraft. The turbine engine is very easy to get damaged due to foreign objects sucked into the aircraft engine such as rocks/gravel, nuts, bolts, which are loose from aircraft parts or from GSE tools scattered on the apron, taxiway and runway. Foreign Object Debris (FOD) can be in the form of living beings such as (birds, snakes, dogs, cats, monitor lizards, etc.) or inanimate objects (inanimate objects) such as bolts, nuts, pebbles, pieces of paper, plastic and metal caps, cloth, or other maintenance tools.

Airside

One part or area of the airport is called the air side. The definition of the air side according to the Minister of Transportation of the Republic of Indonesia Number PM 77 of 2015 concerning Standardization and Certification of Airport Facilities, the Air Side is part of the airport and all its facilities which make it an uncommon area where each person, cargo and means of transportation who wish to come must undergo security checks and obtain special approval. Airside is an area that starts from the apron gate, taxiway and runway which is a private area or not for the public (non-public area).

Aviation Security

Aviation security is civil aviation against disturbing events because it is against the law. What is meant by an unlawful act in aviation security according to Law Number 1 of 2009 concerning aviation is an activity that endangers the safety of transportation flights. The national aviation safety program is a set of integrated aviation safety regulations and activities to achieve the desired level of safety. Aviation safety facilities include: Aviation safety performance targets which mean the aviation safety performance to be achieved in a certain period based on the calculation of the latest period accident data ratio. The aviation safety performance to be achieved and determined by the government must be smaller than the ratio of the latest accident data and the measurement of aviation safety achievement means activities carried out in a planned and sustainable manner to determine the achievement of safety performance targets.

Apron Movement Control (AMC)

Apron Movement Control (AMC) is one of the units in the airport. The definition of Apron Movement Control (AMC) according to the Regulation of the Director General of Civil Aviation Number KP 21 of 2015, Aircraft movement control personnel (Apron Movement Control/AMC) are airport personnel who have licenses and ratings to carry out supervision of order, safety of traffic movements on the apron and the determination of aircraft parking. Supervision is an action that is needed to prevent accidents between aircraft, vehicles, personnel and goods and traffic management so that it can run smoothly.

General Ahmad Yani Airport

An airport is a facility where airplanes can take off and land. In today's modern era, airports are not only used as areas for landing and taking off aircraft, but many facilities have been added, including shops, restaurants and boutiques. The definition of an airport according to Law No. 1 of 2009 concerning Aviation, an airport is an area on land or water with predetermined boundaries that functions as a location for aircraft to land and take off, for people to get on and off, for loading and unloading cargo, intra and intermodal transportation places, and equipped with basic facilities and other supporting facilities besides facilities for aviation safety and security.

Jenderal Ahmad Yani International Airport (IATA code: SRG, ICAO code: WAHS) is an international airport located in West Semarang, Semarang City, Central Java. The coordinates of Jenderal Ahmad Yani International Airport are located on the line 06°.58'.35" LS-110°.22'.38" East Longitude, bordering Kendal Regency to the west, Demak Regency to the east, Semarang Regency to the south, and the Java Sea to the south. North. His name is taken from one of the heroes of the Indonesian revolution General Ahmad Yani. Jenderal Ahmad Yani International Airport is operated by PT. Angkasa Pura I.

After development, this airport has a runway of 2,565 meters x 45 meters, has one terminal covering an area of 58,652 m² with 6 entrances/gates (gates domestic 1A, 1B, 2A, 2B, 3A and international gate 3B), 3 garbarata (aviobridge) and an apron has an area of 72,522 m² with 12 parking stands each for domestic and international flights. With landing capacity for Hercules, Boeing 737, and others. For the Apron area (aircraft parking area) with a capacity of 12 aircraft, departure and arrival terminals and a fairly large parking area. This airport is more or less able to accommodate up to 6.9 million passengers per year and a capacity of 60,000 tons of cargo per year.

Relevant Research

Table 1. Relevant Research

No.	Name	Title	Year	Research Result
1.	Prasetya Barep Putra	Analysis of the Performance of the Apron Movement Control (AMC) Unit to Improve Safety on the Air Side During Rush Hours at Komodo Labuan Bajo Airport	2019	This study shows that the performance of the AMC Unit at Komodo Labuhan Bajo Airport has not been optimal and the facilities at the AMC unit at Komodo Labuhan Bajo Airport have not complied with the applicable regulations because there are several facilities that have not been completed.
2.	Yohanes Oneng B.	The Role of Apron Movement Control Officers in Supporting the Aviation Security and Safety System	2019	This study shows that the role of the AMC unit when supporting the flight security and safety system at El Tari Kupang International Airport is inspection in the runway, taxiway and apron areas and controlling on the air side by issuing policies

		at El Tari Kupang International Airport		related to the operation of vehicles on the air side and following up on several violations committed by the Ground Handling unit where not using airport passes, driving license signs that have expired, licenses and irregular GSE placement.
3.	Yoga Purmadies Utama	The Influence of Apron Movement Control and Ground Handling Unit Performance in Handling Foreign Object Debris on Aviation Safety and Security at Lombok International Airport	2019	The results of this study indicate, to determine the effect of the performance of Apron Movement Control and Ground Handling Units in handling Foreign Object debris on flight safety and security at Lombok International Airport.

RESEARCH METHODS

Research Design

The research design used in this study is a qualitative descriptive research. In this study, the author will use a qualitative descriptive method. The type of research used in this study is a case study, which means a descriptive information report about trial or experimental research data, projects, events or analysis. Case studies in the social sciences involve an in-depth, and detailed examination of the subject of study (the case), and the contextual conditions associated with it. Sugiyono (2017) states that descriptive research intends to describe an event, by conducting a scientific and thorough review. Research that is descriptive in nature and tends to use analysis using an inductive approach. Process and meaning (subject perspective) are emphasized in qualitative research. Descriptive means one type of research whose purpose is to present a complete illustration of a social setting or intended for exploration and explanation of a phenomenon or social reality. This study uses qualitative research techniques because data is collected by means of questions and answers and observations, the results of which are in the form of sentences and documentation are used to answer research problems. Data combined through interview and observation methods and supported by documentation in the form of photographs/pictures were then analyzed and described.

Research Subject

The research subjects in this study were Apron Movement Control (AMC) officers. The selection of research subjects used purposive sampling and snowball sampling methods. Purposive sampling is a sampling technique using exclusive considerations. This exclusive consideration, for example that person is claimed to know best about what we expect or maybe he is the ruler as a result will make it easier for researchers to explore the object/social situation under study (Sugiyono, 2005). Meanwhile, the snowball sampling technique is a sampling technique for data sources, which at first are small in number, gradually become large. This was done because the small amount of data was not yet able to provide satisfactory data, so they looked for other people who could be used as data sources. This snowball sampling technique was used to select Apron Movement Control (AMC) officers as research subjects. The reason researchers chose this technique is because the data collected can provide satisfactory data. So when from one source the data is still incomplete, we can take data from other information.

Time and Place of Research

This research was conducted from 01 August 2022 to 30 September 2022 at PT. Angkasa Pura I Ahmad Yani International Airport Semarang. This research focuses on the AMC Unit. The

author chose this research because he has an interest in the issues raised regarding the handling of Foreign Object Debris (FOD) findings on the air side for aviation safety and security at Jenderal Ahmad Yani International Airport Semarang.

Data Source

1. Primary Data. Sugiyono (2017), states that primary data is a source of data that directly provides data to data collectors. In this study, the primary data sources were obtained by researchers through interviews and observations of Apron Movement Control officers; (AMC) at PT Angkasa Pura 1 (Persero) General Ahmad Yani International Airport Semarang.
2. Secondary Data. Sugiyono (2018), states that data that is not personally provided to researchers is claimed as secondary data, generally in the form of document files or through other people. Secondary data sources are additional information sources that are useful in fulfilling the information needed by the main information. Researchers receive additional data through various sources, ranging from books, journals, articles, information and previous research as supporting data as well as complementary data. Secondary data in this study consisted of data that the authors encountered regarding the control that was carried out through AMC personnel.

Data Collection Technique

1. Interview. Sugiyono (2018) says, interviews mean dialogue with exclusive intent which is carried out by two parties, namely the interviewer who asks questions and the interviewee to provide answers to the questions given to obtain the required information. The type of interview used in this study was a semi-structured interview where the interviewer had prepared topics and a list of questions before the interview was carried out (Sarosa, 2017). The interview guide that has been prepared is still capable of development as the interview process progresses. in this interview method contains questions that will be asked to the speakers consisting of Airline Service Supervisor (ASS), AMC Officer, AMC Data Entry Officer, and Aviobridge Operation Officer AMC International Airport General Ahmad Yani Semarang
2. Observation. Tersiana (2018), defines observation, namely the process of thorough observation and observing attitudes in an exclusive condition. Basically, observation aims to describe activities, people, and the meaning of events according to an individual's perspective. In conducting the observation, the author wants to know directly about the findings that were found during the observation at the unit, in this case the researcher observed the impact of Foreign Object Debris and what is the role of Apron Movement Control (AMC) officers in handling Foreign Object hazards. Debris on the air side.
3. Documentation. Documentation is a method that can be used by the author to obtain data directly from the research area, so that the writer obtains relevant data. The data obtained from the research area can be in the form of regulations, activity reports, photos, documentaries, and other data (Sudaryono, 2017). During the research, the researcher documented the inspection activities carried out by Apron Movement Control (AMC) officers and the types of Foreign Object Debris (FOD) found in the airside area such as dead birds, dead snakes, twigs, hot air balloons, oil spills or oil, crushed concrete and asphalt.

RESEARCH RESULTS AND DISCUSSION

The impact of Foreign Object Debris on the airside at Jenderal Ahmad Yani International Airport, Semarang

Based on the results of the data that has been processed by the Impact Analysis of the presence of Foreign Object Debris (FOD) on the air side for aviation safety and security at

Jenderal Ahmad Yani International Airport Semarang, it can be measured based on several indicators in this study, namely regarding air side surveillance is one of the an important part in supporting security and safety on the air side, especially in vital parts that have a major influence on flight safety. The role of the officers who carry out direct supervision of the apron area, Apron Movement Control officers always carry out surveillance and inspections using a follow me car every 2 (two) hours on a regular basis with the aim of knowing whether the apron area and the air side are clean of foreign object debris which may interfere with flight safety and security.

In this study, from 1 August 2022 to 30 September 2022 at Ahmad Yani Airport, researchers collected observational data on the forms of Foreign Object Debris, namely as follows: Kites, scattered pebbles; Plastic, metal, razor blades, oil and grease spills; Items such as screws, nuts, bolts, and nails; cargo straps, fabrics, embroidery paper; Pieces of bags, suitcase padlocks, pieces of airplane tires; As well as living creatures such as birds, snakes, monitor lizards, and other animals. In his explanation above, the impact of Foreign Object Debris at Jenderal Ahmad Yani International Airport in Semarang is as follows: There is a delay on aircraft from Lion Air and Citilink airlines that wish to land and take off due to Foreign Object Debris in the side area. air in the form of kites and wild animals in the form of birds so that Apron Movement Control officers must coordinate with PKP-PK officers and other stakeholders to clean up Foreign Object Debris which is on the air side (Airside). There was a leak in the official car tires of the Apron Movement Control unit officers and the cargo train tires belonging to the ground handling officers due to the presence of Foreign Object Debris in the form of bolts, causing problems with the performance of the officers when working and conducting surveillance on the air side. Foreign Object Debris can originate from airport infrastructure, personal belongings carried by passengers or officers left in areas where they shouldn't be, activities on the airside for example such as loading and unloading of goods, refueling aircraft and other activities carried out by ground handling officers and Pertamina officers, as for environmental factors such as the presence of children playing kites in villages close to the airport so that broken kites often enter the airport area and it is also not uncommon for wild animals such as monitor lizards, snakes and birds entering the airside area.

Based on the description above, the existence of Foreign Object Debris is very disturbing for flight activities in addition to causing delays on flights. aircraft, this is very dangerous for the safety and security of cabin crew and all aircraft passengers. Therefore to prevent delays in aircraft activities and fatal accidents to aircraft that occur due to Foreign Object Debris at Jenderal Ahmad Yani International Airport Semarang based on question and answer and observations conducted by reviewers more or less as follows: Providing outreach to the public around the environment, for example schools, residential areas, and at the nearest village hall that flying kites in the airport environment is very dangerous for flight safety and security. Conduct outreach to stakeholders in charge of the airside area when carrying out their duties so that it is carried out carefully and is always stricter and more optimal in maintaining cleanliness in the airside area. Making posters or billboards is prohibited from flying kites in the airport area. Making advertisements about the importance of not playing kites, drones, and selling in the area outside the airport, namely in the outer parameter fence area because there is fear that the garbage on the outside of the airport will enter the airborne side due to wind blowing, with the implementation of several points - it is hoped that in the future there will be no more problems such as delays in flight activities, leaking car tires and ground handling trains due to Foreign Object Debris on the air side so that safe and secure flights can be created. even better.

Handling Foreign Object Debris carried out by Apron Movement Control unit officers at General Ahmad Yani International Airport Semarang as an effort to maintain flight safety and security

In accordance with the results of the question and answer and the results of observations carried out by the handling reviewer carried out by the Apron Movement Control unit officers in handling the Foreign Object Debris hazard on the air side at Ahmad Yani Airport Semarang, the AMC unit officers have carried out their duties in sync with the standard operating procedures contained as follows: Check and ensure that the apron surface is clean from foreign objects that can cause damage to the engine and other parts of the aircraft, thus potentially disrupting flight operations. Control the cleanliness of the apron every morning before the first flight and on an ongoing basis to ensure the surface of the apron is in a clean condition. Inform airline officers and ground handling agents to clean up oil spills or get rid of trash and used goods on the air side which are the responsibility. Provide direction to airline staff, ground handling and people who work on the apron to jointly maintain cleanliness on the air side. The AMC unit also monitors wild animals in the airside area by coordinating with related units, namely AVSEC and PKP-PK if wild animals are found entering the airside area. Coordinate with related units, namely the Airport Infrastructure Service to clean up Foreign Object Debris on the apron if the condition of the apron is dirty or there is Foreign Object Debris.

In carrying out Foreign Object Debris settlement, the role of Apron Movement Control at General Ahmad Yani International Airport, Semarang, is to always carry out periodic inspections at least once every 2 hours to check the apron area, taxiway, runway, and parameter areas. This is done so that if Foreign Object Debris is found Those on the air side, such as kites, paper, plastic, wild animals, and others, must be cleaned and handled immediately. Apart from that, the Apron Movement Control unit officers also coordinate with all units on the air side to carry out Safety Campaign Foreign Object Debris activities, which in the Standard Operating Procedures for Apron Movement Control unit officers, this is done once a month, but this depends on the presence of Foreign Object Debris in the field. If the apron has Foreign Object Debris and looks dirty, then the Foreign Object Debris Safety Campaign will be carried out once a week.

In addition to handling the above Foreign Object Debris, especially wild animals in the form of birds, handling can be carried out by using a device that emits high-frequency sounds to disturb the comfort of the birds so that these birds move from the airport environment. Apart from that, the use of the sounds of predators that mostly manipulate birds, while the birds will realize that they are not safe and then run away, apart from disturbances in the form of devices that make sounds, you can also use devices that emit light to shoot at groups of birds at the airport, since The laser-like light will then block the view of a group of birds using the target to scatter the birds. Reducing mangrove plants around the airport, because mangrove trees become nests for birds so if reduced or used up it will reduce the bird population around the Semarang General Ahmad Yani International Airport area.

CONCLUSION

The impact of Foreign Object Debris is very influential for aviation safety and security. Due to the cleanliness of the apron area on the air side from foreign objects or Foreign Object Debris such as kites, pebbles, bolts, nuts, suitcase padlocks, pets and wild animals such as dogs, cats and monitor lizards, and the remaining ground handling activities can cause delays and accidents to aircraft if the foreign object is sucked into the aircraft engine and can damage other parts of the aircraft components so that the task of the Apron Movement Control unit must be

as optimal and optimal as possible to ensure that the apron and the air side clean from the presence of foreign objects or Foreign Object Debris. The role of the officer in the Apron Movement Control unit of PT. Angkasa Pura I in handling the Foreign Object Debris hazard at Jenderal Ahmad Yani International Airport Semarang by following the applicable Standard Operating Procedures and carrying out routine checks and coordinating with units arriving in the airside area of Ahmad Yani Airport Semarang, handling Foreign Objects Debris has been done to the fullest and optimal.

The author's suggestion is: For companies, it is hoped that companies will socialize to the public about the dangers of foreign objects (Foreign Object Debris), for example, kites, drones, hot air balloons, paper, plastic, livestock such as dogs and cats, which enter the side area air if sucked into the aircraft engine which causes damage to the aircraft and other parts resulting in an accident to the aircraft. For future researchers, the results of this study are expected to be a source of literature and provide knowledge for future researchers who conduct similar research regarding the impact of Foreign Object Debris on the airside at Jenderal Ahmad Yani International Airport Semarang.

BIBLIOGRAPHY

- Angkasa Pura I. 2021. Bandar Udara Internasional Jenderal Ahmad Yani Semarang dalam <https://ahmadyani-airport.com/id> (Diakses pada tanggal 16 Januari 2022, pukul 20.00 WIB).
- Annex 14, Vol 1 Aerodrome Design and Operation, Fourth Edition, July 2004.
- Destiana Sari, Chindy. 2021. Optimalisasi Pengawasan Unit Apron Movement Control (AMC) Terhadap Kebersihan Sisi Udara (Airside) Dari Foreign Object Debris (FOD) Di Bandar Udara Internasional Jenderal Ahmad Yani Semarang. Tugas Akhir. Sekolah Tinggi Teknologi Kedirgantaraan Yogyakarta.
- Direktur Jenderal Perhubungan Udara Nomor KP 326 Tahun 2019 tentang Standar Teknis Operasional Peraturan Keselamatan Penerbangan Sipil.
- Direktur Jenderal Perhubungan Udara Nomor SKEP/100/XI/1985 tentang Peraturan Dan Tata Tertib Bandar Udara.
- Fahlia, F., Irawan, E., & Tasmin, R. (2019). Analisis Dampak Perubahan Perilaku Sosial Ekonomi Masyarakat Desa Mapin Rea Pasca Bencana Gempa Bumi. *Jurnal Ekonomi Dan Bisnis Indonesia*, 4(1), 51–55. <https://doi.org/10.37673/jebi.v4i1.362>
- Hutagaol, Desmond. 2013. *Pengaturan Penerbangan Perspektif Profesional*. Jakarta : Erlangga.
- Pambudi, Bima. 2022. Peran Petugas Apron Movement Control Dalam Menjaga Kebersihan Di Sisi Udara Pada Bandar Udara Sultan Hasanuddin Makasar. Sekolah tinggi Teknologi Kedirgantaraan Yogyakarta.
- Peraturan Menteri Perhubungan Republik Indonesia Nomor PM 77 Tahun 2015 tentang Standarisasi Dan Sertifikasi Fasilitas Bandar Udara.
- Sudaryono. 2017. *Metodologi Penelitian*. Jakarta: Rajawali Press.
- Sugiyono. 2012. *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.
- Sugiyono. 2017. *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Undang-Undang Republik Indonesia No.1 Tahun 2009 Tentang Penerbangan.