Analysis and Characterization of Domestic Air Travel Delay of Low-Cost Airlines at NAIA Terminal 4 for the Year 2015

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Abstract: The mobility of passengers in air travel may be greatly improved if the occurrence of flight delays and its impacts are lessened. The analysis of delayed flight details of all domestic flights from low-cost airlines operating at NAIA Terminal 4 will help determine the causes of delays and the trend of arriving and departing flights for the year 2015. Factors causing the delays were characterized and analyzed in this paper, including the number of times a cause of delay occurred and total accumulated time of delay at NAIA Terminal 4. The research revealed that the most impactful cause of delay was due to runway restrictions and staff shortage at the destination airport. This cause of delay occurred 2,893 times and caused about 213,412 minutes of delay.

Keywords: Air Travel, Flight Delays, Causes of Flight Delays, Operations and Management of Air Transport

1. INTRODUCTION

In 2015, Ninoy Aquino International Airport (NAIA) decided to limit Terminal 4 to serve domestic flights only. This prompted airlines such as AirAsia and Cebgo to spend their resources on the market of low-cost flights. The emergence of low-cost airlines enabled many to experience traveling to other international and local destinations. *Figure 1* shows that about 91 % of the total domestic flights in NAIA Terminal 4 are from low-cost flights while only 9 % are from the standard rate flights.

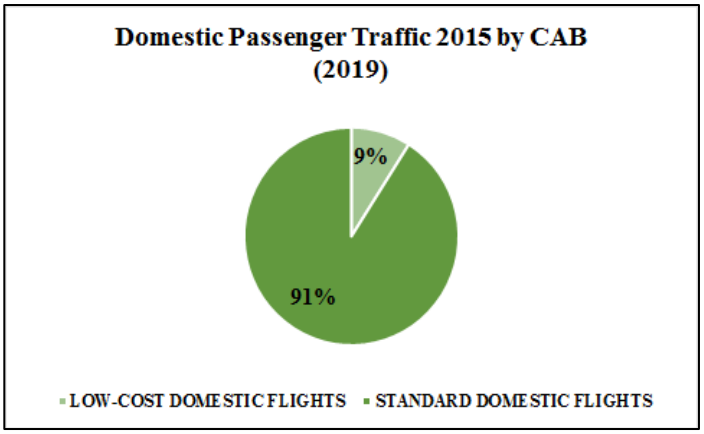
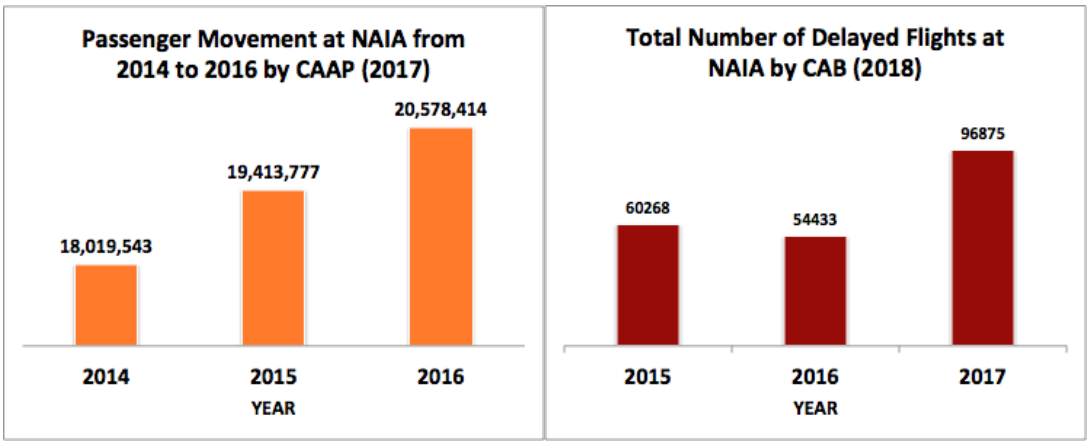


Figure 1. Domestic Passenger Traffic 2015 by CAB

Statistical reports produced by the Civil Aviation Authority of the Philippines (CAAP) for years 2014 to 2016 show that there is an increasing demand for domestic flights each year. In

Figure 2, a total of *18,019,543* departing and arriving passengers of domestic flights were recorded for 2014, while *19,413,777* and *20,578,414* passenger movements were recorded for 2015 and 2016, respectively. *Figure 3* illustrates an increasing number of delayed flights per year as reported by the Civil Aeronautics Board (CAB) (2018). The available data show that in 2017, delayed flights occurred more frequently as compared to years 2015 and 2016. Different factors, such as aircraft rotation, air traffic flow management (ATFM) due to air traffic control (ATC), and consequence to ATFM restrictions, cause a flight to be delayed.



Figures 2 & 3. Passenger movement at NAIA from 2014 to 2016 by CAAP - 2017 data (Left) and Total number of delayed flights at NAIA from 2015 to 2017 by CAB - 2018 data (Right)

With the more prevalent presence of low-cost airlines and more flight routes offered to the public, delay in flights have significantly increased. One of the recent problems encountered by NAIA concerning delay was the accident at the runway involving a Boeing B737 type aircraft of Xiamen Airlines. Although there were no fatalities or injuries reported, the accident caused numerous flight delays, rerouting, and cancellations at NAIA (Business World, 2018). Such instance demonstrated how one flight can affect the succeeding flights. It also highlighted the importance of determining and analyzing how a problem or a situation can affect the flight, its passengers, and the whole system of airports as well.

Known as the Manila Domestic Passenger Terminal, Terminal 4 is regarded as the oldest airport in Manila built in 1948, which currently operates for domestic flights only (NAIA, 2019). *Figure 4* shows the terminal's location near the far end of the runway at NAIA. The terminal caters to four (4) airlines namely AirSWIFT, Skyjet, Cebgo (Cebu Pacific Air), and AirAsia. The latter are two (2) low-cost airlines operating at the terminal. Eight (8) *ATR 72-500* and ten (10) *ATR 72-600* are included in Cebgo's fleet as of May 2018, while Philippine AirAsia have a fleet consisting of twenty-one (21) *Airbus A320-200* as of April 2018.

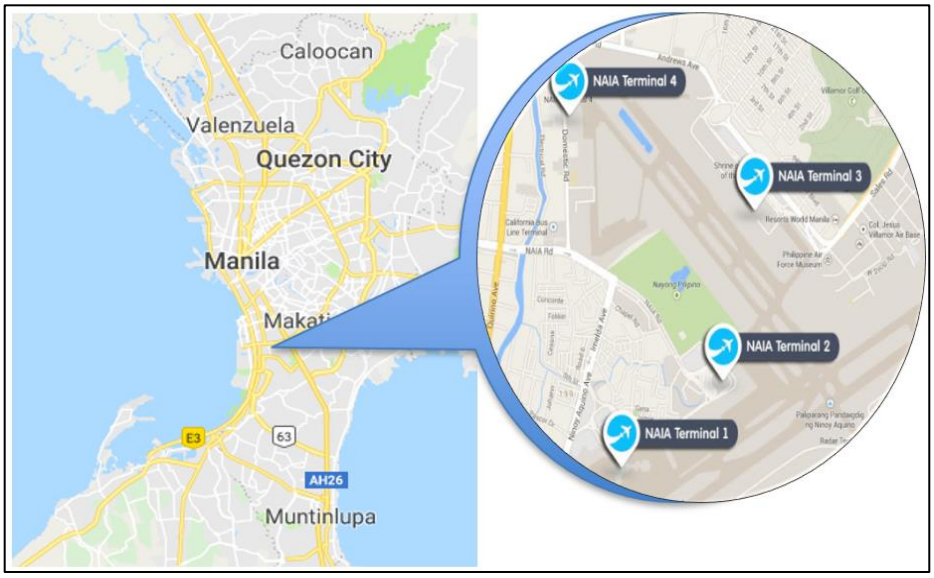


Figure 4. Location of Terminal 4 at NAIA
(Image Source: Google Maps)

1.1. Objectives

The main objective of the study is to characterize the delayed flights at NAIA Terminal 4 for the year 2015 according to its causes, number of occurrences, and accumulated minutes of delay by (1) determining the most frequently occurring cause of delay, (2) identifying the cause of delay with the longest accumulated duration, and (3) determining the seasonal trend of flight arrival and departure at NAIA Terminal 4.

1.2. Scope, Limitations, and Delimitations

The study focuses on characterizing the different causes of domestic flight delays at NAIA Terminal 4, as well as the seasonal trend of flights for 2015. The study is limited to analyzing flights for passenger type aircrafts operated by low-cost airlines at Terminal 4. However, since the use of the Cebgo brand of Cebu Pacific was effective on May 11, 2015 through Cebu Pacific's acquisition of Tigerair Philippines (Cebu Pacific Air, 2019), data on Cebgo flights for the year 2015 were not available, thus only flights operated by Air Asia will be analyzed in this study.

Terminal 4 was chosen for analysis as it is the only terminal that operates solely on domestic flights. Terminals 1, 2, and 3 are not included in the study. Flight details were provided by government agencies, namely Manila International Airport Authority (MIAA) and Civil Aeronautics Board (CAB).

2. RELATED LITERATURE

2.1. Air Travel Delay

When an aircraft's actual take off and landing travel time do not coincide with its scheduled travel time then it is already considered as delayed. The Federal Aviation Administration (FAA) reported that 70% of air travel delays in the United States are caused by bad weather that decreases visibility in the sky, 15-20% are caused by an overabundance of aircraft which exceeds the airport's capacity and airspace, and about 10% are caused by minor airport equipment failures and runway shutdowns (Morrison & Winston, 2008).

2.2. Air Traffic Control

The Federal Aviation Administration (FAA) established a system to control the air traffic volume in the airport known as the Ground Delay Program (GDP) or FAA Flow Control. Control Departure Times (CDT) are assigned to all flights, only allowing them to take off at a specific time, which is how the system controls the flow of traffic. It is ensured that the number of departures is equal to the number of demand through calculating and controlling the CDTs.

2.3. Air Traffic Management

Air traffic management (ATM) is an important aviation infrastructure that produces the transportation of individuals and product a lot of convenience. Through the help of air traffic control, ATM is able to give the required connecting infrastructure that allows aircraft to fly safely between airports. ATM separates aircraft from air traffic flow to be able to supply services that are essential for safe and efficient air transport (Arblaster, 2018).

2.4. Airport Passenger Demand

In a study by Alvarez and Amis (2006), population, distance, and flight frequency are the crucial factors needed to be considered in accommodating for the demands of the passengers in the airport. Since a large percentage of flights in the Philippines are focused on NAIA, other airports across the country are underutilized.

3. METHODOLOGY

Quantitative research was done by gathering domestic flight details of Air Asia for the year 2015 from MIAA and CAB. The raw data was sorted and filtered in chronological order from January 2015 to December 2015. The date of flight, scheduled departure time, route/sector, duration of delay, and cause of delay were identified for all domestic flights. Peak season of delayed flights were also determined monthly. The analysis of data involved the determination of the top causes of delay according to frequency and the accumulated duration of the cause of delay.

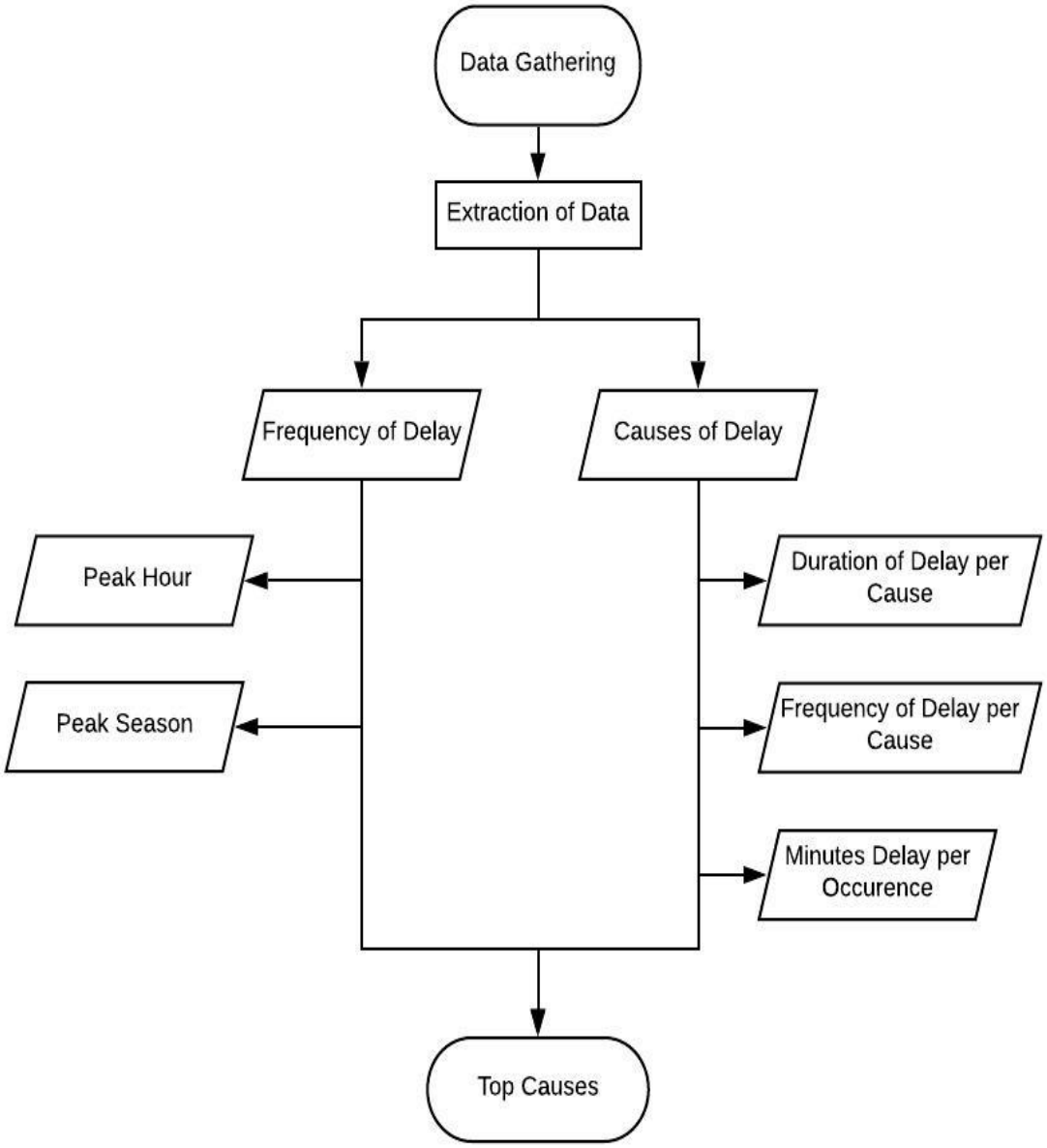


Figure 5. Summary of Procedure

4. RESULTS

4.1. Peak season volume of delayed flights

Figure 6 shows the percentage of delayed flights per month of the year 2015. Flight delays peaked in the months of February, April, May, July, and December, where July data showed the greatest percentage of delayed flights. The flight delays dropped on the months of March, June, and September, with March being the lowest.

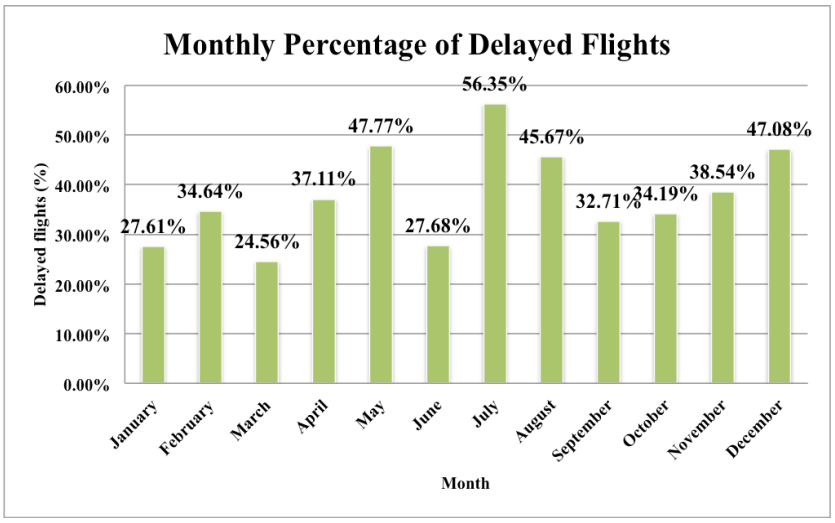


Figure 6. Percentage of Delayed Flights per Month

Figure 7, on the other hand, presents the frequency of delays per day of the week. The graph showed that more delays occurred on Sunday, Wednesday, and Friday while the delays occurred less during Monday, Tuesday, Thursday, and Saturday. The graph revealed that the delays occurred about nine hundred (900) times in average everyday for the year 2015.

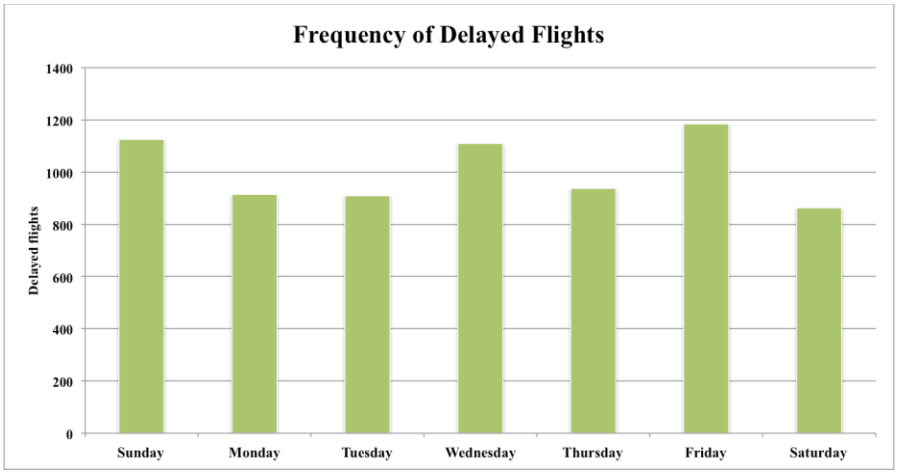


Figure 7. Frequency of Delayed Flights per Day in a Week

4.3. Peak Hour Volume of Delayed Flights

Figure 8 shows the hourly delays in Philippine Time (PHT). In the morning, the delays peaked during 7:00 AM, where flight delays occurred about one hundred (100) times. In the afternoon, the delays peaked during 5:00 PM at an average of seven hundred (700) times, while in the evening, the delay peaked during 8:00 PM, where flight delays occurred about six hundred (600) times. The graph illustrates that flights are less delayed in the morning and it would peak at the afternoon then would then proceed to drop on the evening.

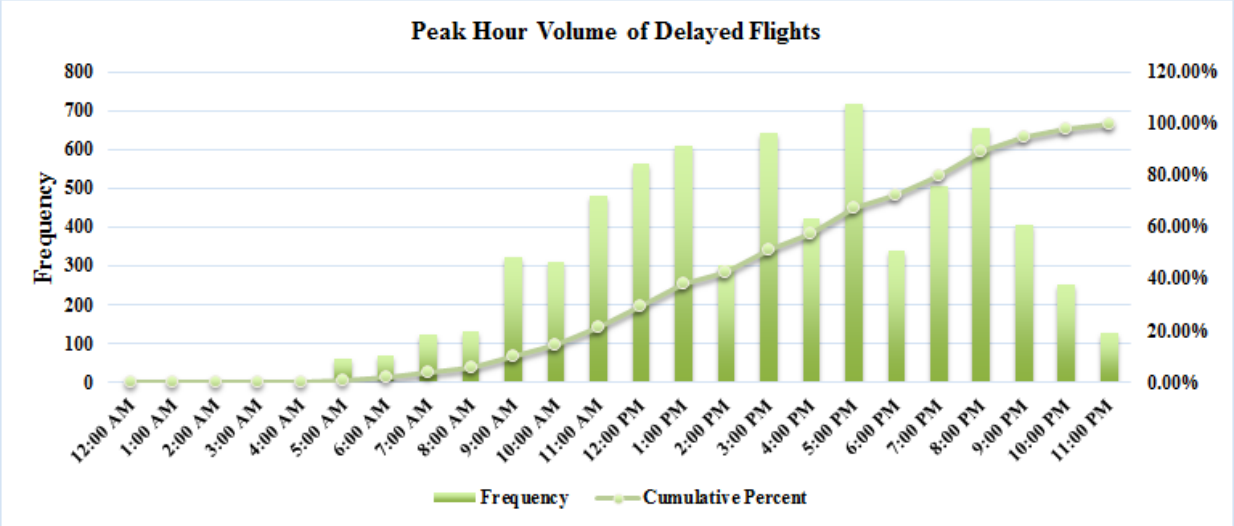


Figure 8. Peak Hour Volume of Delayed Flights

4.3. Analysis of the Causes of Delays

Flights can be classified into two types: arriving and departing flights. Arriving flights, in this context, are flights landing at NAIA Terminal 4 while departing flights are flights taking off from NAIA Terminal 4. 52% of the total flights are comprised of arriving flights, while only 48% can be attributed to departing flights. The difference of 4% can be considered as significant, implying that there are also issues encountered in other domestic airports.

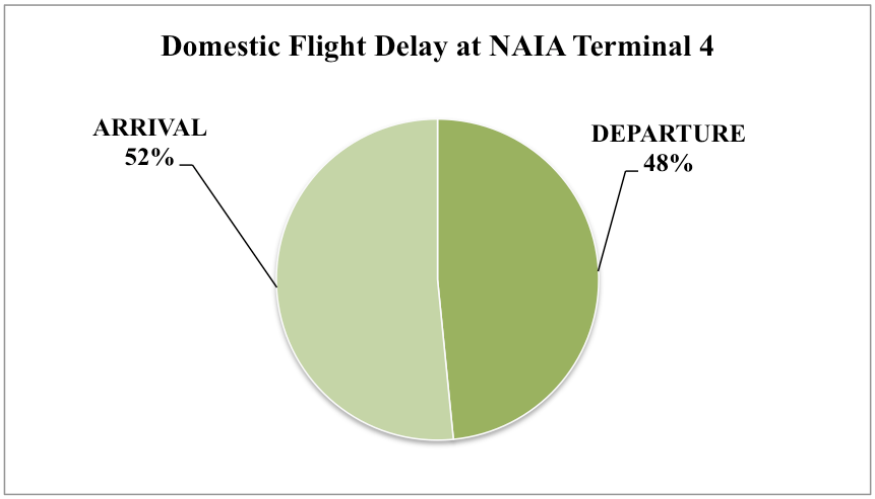


Figure 9. Delayed Departure and arrival at Terminal 4

Table 1. Causes of delayed flights

Cause of Delay	Frequency	Percentage
1. Restrictions at destination airport	2885	40.96%
2. Standby aircraft	729	10.35%
3. Technical defects	567	8.05%
4. Restrictions at the airport of departure	462	6.56%
5. Aircraft change	447	6.35%
6. Others	1953	27.72%

The causes of delay with high frequencies shown in *Table 1* were identified as *restrictions at destination airport, standby aircraft, technical defects, restrictions at airport of departure*, and *aircraft change*. *Others* are composed of 51 identified causes of delay, with 0.01% to 4.38% delayed flights associated to each. 41% of delayed flights are caused by restriction at destination, which is the top cause of delay in 2015. According to the delay codes provided, *restrictions at the destination airport* is caused by several reasons such as airport and/or runway closure due to obstruction industrial action, staff shortage, political unrest, noise abatement, night curfew, and special flights, among others. Delays due to *technical defects* and *standby aircraft* are among the top three (3) causes in terms of frequency. Based on the delay codes provided, *technical defects* mean that the assigned aircraft for a particular flight has a defect. On the other hand, delays due to *standby aircraft* mean that the back-up aircraft is unavailable for technical reasons. Routes of delayed flights due to restriction at destination airport and airport of departure were identified (*see Table 2*). Among the destinations and airports of departure having a high frequency of delayed flights due to restriction are NAIA (MNL), Kalibo International Airport (KLO), and Mactan Cebu International Airport (CEB).

Table 2. Delays caused by restriction at destination airport and at the airport of departure

Restriction at destination airport		Restriction at the airport of departure	
Route/Sector	**Frequency**	**Route/Sector**	**Frequency**
KLO-MNL	679	MNL-CEB	68
MNL-KLO	616	MNL-PPS	63
CEB-MNL	318	MNL-KLO	62
PPS-MNL	283	KLO-MNL	42
MNL-CEB	240	CEB-MNL	41
TAC-MNL	223	MNL-TAC	39
MNL-PPS	121	PPS-MNL	31
DVO-MNL	120	MNL-DVO	28
MNL-TAG	82	TAC-MNL	28
TAG-MNL	79	DVO-MNL	27
MNL-TAC	70	MNL-TAG	20
MNL-DVO	54	TAG-MNL	13

Restriction at destination airport, standby aircraft, aircraft change, technical defects, and weather at destination station were among the top causes of delay in terms of its duration in minutes (*see Table 3*). Based on the data, it can be inferred that that *restriction at destination airport* and *aircraft defects* are two major causes of delay because both were also identified as the top two causes of delay in terms of frequency.

Table 3. Total duration of delayed flights per cause of delay

Cause of Delay	Duration of Delay (mins.)	Percentage
2. Restrictions at destination airport	213,831	40.96%
2. Standby aircraft	119,008	10.35%
3. Aircraft change	59,295	8.05%
4. Technical defects	57,465	6.56%
5. Weather at destination station	40,959	6.35%

5. CONCLUSION

The cause of delay with the highest number of occurrences is restriction at destination airport, with a frequency of 2,893 times, and caused approximately 213, 412 minutes of delay, having the most impact among the identified causes.

The findings suggest that the runway at the airport is not adequate to accommodate all of the flights, as the top cause of delay is due to the restriction on the destination airport. Given the current design of the runway at NAIA, if the first flight to depart is delayed by a significant amount of time, it causes a ripple effect to all other flights that follow. A new building or airport that is solely for domestic use is recommended to lessen this.

In order to address delays due to aircraft defects, which was also identified as a significant cause, it is recommended to have a re-evaluation of the aircrafts used by AirAsia.

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