

Aviation Demand for the Construction of a Runway in Kandy

SHGT Silva¹, RMNT Sirisoma², and PC Dissanayake³

¹ Defence Services Command and Staff College, Sri Lanka

² General Sir John Kotelawala Defence University, Sri Lanka

³ Defence Services Command and Staff College, Sri Lanka

Abstract— Analysis of the aviation demand is one of the pre-requirements to decide the construction of a new runway. It revealed that the aviation demand was not investigated through a proper study with relevance to Kandy. The aim of the research was to examine the domestic aviation demand for scheduled flights for a runway in Kandy. Decision analysis was the method used for analysing where analysis is done by the combination of both qualitative and quantitative techniques using both primary and secondary data. The techniques used for analysing were liner regression analysis, potential user survey and trend projection methods. It was found that there is no significant demand for scheduled flights to Kandy and no demand to base the aircraft at a runway in Kandy at present. It revealed that the numbers of passengers travel by the scheduled flights in Sri Lanka have been declined and it will further decrease. According to the outcomes, further consideration of the runway construction seems not worthy and viable but the decision should be finalized after reviewing total domestic aviation demand.

Keywords— Aviation Demand, Domestic Flight, Decision Analysis, Potential User Survey, Scheduled Flights.

I. INTRODUCTION

Transportation is the act of moving something from one place to another. Road, rail, water, air and pipeline are the major modes of transportation. The infrastructure on which transport systems depend includes roads, highways, railways, waterways, bridges, bus stations, railway stations, harbours and airports, which are fixed installations. Transportation network in Sri Lanka is well connected mainly based on road transport, in addition to an extensive railway, navigable waterways, and domestic flights. Both public and private transport services exist in the country.

Air transport is considered as a quick and a comfortable mode of transport, but it needs more infrastructure and other related facilities. A strip of hard ground, along which an aircraft take off and land, is called a 'runway'. All flights that fly between points within the domestic boundaries of a country are called as 'domestic flights'. An airport that only handles domestic flights is a domestic airport.

Travel by air provide several advantages such as speed and less time, multiple visits in short durations, avoiding stress of road travelling, and extra cost for accommodation. This may also involve certain disadvantages such as weather effects, sensitivity to technology and cost. As a small island, Sri Lanka can offer a speedy and a comfortable mode of travel through an effective domestic aviation network.

This study aimed at estimating the domestic aviation demand for scheduled flights for a runway in Kandy. The objectives of the research includes; to study the present situation of the domestic aviation field in Sri Lanka, to examine the interest of the potential users for a runway in Kandy, to examine the aviation demand to base the aircraft, if there is an airfield in Kandy and to make recommendations in need of constructing the runway in Kandy.

A. Background of the Study

In view of developing the domestic aviation in Sri Lanka, especially to boost the tourism, the government had a plan to construct six new domestic airports and expand 10 existing airports. As per the National Physical Planning Policy and Plan 2010-2030 (2011), the new airports were planned to construct in Mannar, Kandy, Nuwaraeliya, Mankulam, Monaragala, and Dambulla.

In 2013, construction of a runway in Kandy had been initiated to enhance the transport facility to Kandy through the development of domestic aviation. The ultimate aim of this runway construction was to achieve the maximum benefits of the country's booming tourism industry by making Kandy city more attractive, through the development of domestic aviation (Embassy of Sri Lanka Rome, 2013).

The plan was to construct a domestic airport with a runway of 1,200 metres long and 25 metres wide, in a 35-acre plot of land in Theldeniya, Mahaberiattenna area in Digana, Kandy. The land area included part of a livestock farm in Tennekumbura which is one of the country's most fertile lands needed for agricultural experiments and investigations.

B. Prerequisites for Construction of a Runway

Market area identification, aviation demand forecasts, financial analysis, economic impact assessment, social impact analysis, environmental impact analysis/assessment, airspace analysis, airfield configuration analysis, land use and land acquisition analysis, construction impacts analysis and operational analysis are pre-requisites for construction of a runway. The understanding of the type of airport which has been considered and level of demand for an airport are vital before analysing the impacts of an airport (URS Australia Pty Ltd, 2006). Analysing the aviation demand is an important pre-requisite to decide the construction of a new runway, and the requirement of a runway should be properly studied and correctly identified at the planning stage (ICAO, 2006).

C. Aviation Demand Analysis in Sri Lanka

Aviation demand in Sri Lanka has been considered and the forecasts have been prepared to develop domestic airports during the planning process (Sri Lanka. Airport and Aviation Services (SL) Ltd, 2002 & 2003). In these plans, the demand for domestic aviation has been mostly estimated on many assumptions, even though some statistical data had been used. The analyses were mainly based on tourist traffics, and the results of those aviation demand analyses are not systematically sound. Though the traffic demand analyses have been done for the developments of some domestic airfields and for the Southern International Airport (MRIA), the traffic forecasts were found unreliable.

D. Research Problem

Construction of the runway, which commenced in Kandy in 2013, has been suspended in 2015 after preliminary works that consumed a considerable amount of money. Construction of a runway is a long-term investment and a mega project that demands the investment of several billions of rupees. The necessity of a runway cannot be changed within a short period of time, as it needs an extensive study to correctly identify its actual requirement. Further, construction of a runway influences different sectors such as environment, social, economy, domestic aviation, tourism, and national security.

A proper survey or studies on the impacts of construction of runway in Kandy, which are essential pre-requisites to determine the construction of a new runway, were unavailable. It revealed that an aviation demand analysis has not been performed. To undertake a major project such as construction of a runway, there should be a visible requirement or demand, which was not investigated through a proper study with relevance to Kandy.

II. METHODOLOGY

The positivism approach was used for the research which highly structured and based on numbers and statistics. This research adopted a mixed method, which is the combination of qualitative and quantitative approaches.

This research estimated the number of passengers for scheduled flights and scheduled aircraft movements that the airport would generate, and the demand to base aircraft, in an airfield in Kandy. The research studied the present trends of domestic aviation field in Sri Lanka and investigated the factors that affect the domestic aviation demand.

In the Decision Analysis method, the evaluation is based on the combination of both qualitative and quantitative methods. Three types of methods or approaches were applied to analyse the aviation demand in order to have more reliability. The passenger demand between Kandy and other airfields were generated through the model created by liner regression analysis method of econometric model, in which, the number of trips could be obtained.

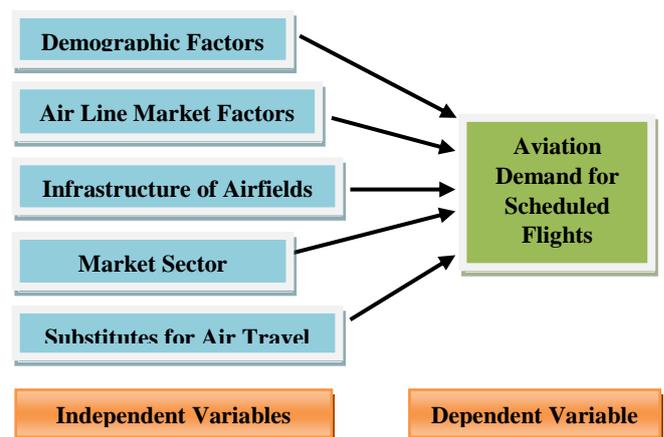


Figure 1: Conceptual Framework for Regression Analysis
Source: Created by the Researcher, 2017

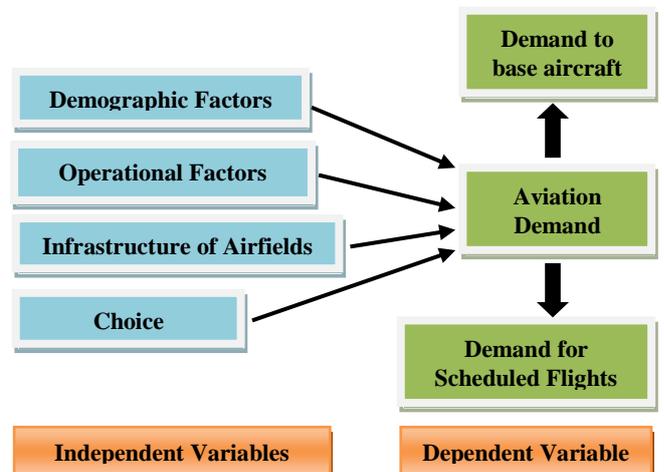


Figure 2: Conceptual Framework for Potential User Survey
Source: Created by the Researcher, 2017

A potential user survey using Delphi method helped to find the demand for a new airport in Kandy through a survey study, which involved all domestic operators. The simple trend projection of time series model was also applied for the forecasting purposes. Finally, the analysis was performed by combining all three methods.

Methodology of conducting this study depended on both primary and secondary data. In the research, the target group for primary data was domestic operators in Sri Lanka, and these data were gathered using a questionnaire distributed among all domestic flight operators in the country. Data related to all airfields in the country and with reference to Kandy, factors affects on domestic aviation demand and domestic flights movements and passenger details were collected from available reports, documents, and internet. Data were analysed by SPSS and MS Excel. Further, research provided the recommendations in need of constructing the runway in Kandy and in view of improving the domestic aviation sector in Sri Lanka.

Collections of some of the secondary data were limited to available information. Comprehensive historical data related to the domestic flight movements and passengers were not available except Helitours, and domestic schedule flight movements were limited to few airfields. In 2016, domestic scheduled movements between airfields in Sri Lanka have been done only by MA-60 aircraft. Therefore data on domestic scheduled movements were very limited.

Out of all airfields in the country, Weerawila was not considered for the regression analysis, as Mattala airfield is located in the same region, and only Palaly airfield was considered from the Northern region due to lack of tourist data. Ampara airfield was not considered due to same reasons as above, but all other airfields were contemplated for the study.

III. RESULTS AND DISCUSSION

A. Present Situation of Domestic Aviation in Sri Lanka

Presently, there are 16 runways/airfields available in the country for air operations and all the airfields are freely available for civil domestic air operations. All domestic/military airfields have comparatively short runways suitable to handle short- or medium- haul aircrafts. MA-60, the largest aircraft in the sector, cannot be operated at Sigiriya, Katukurunda, Koggala, Weerawila, and Mulative. Further, Kandy or even the central province has no runway at present. The nearest airfield to Kandy is at Sigiriya, which is about 40 NM (air distance) away and more than 2 hours drive time from Kandy.

Other than the airfields, there are water aerodromes in the country for amphibian air operations. Water aerodrome network has covered many part of the country. Victoria and Polgolla water aerodromes are located closer to Kandy city.

All domestic flight operators in Sri Lanka were based in three airfields; i.e. Rathmalana, Katukurunda, and Katunayake. There were 42 aircraft available in the domestic aviation sector in Sri Lanka, including fixed wing aircraft, float planes and the helicopters. Domestic flight operators carried out charter flights, flight training while only two (2) operators did scheduled flights in 2017.

Passenger data of Helitours Pvt Ltd during 2013 - 2016 years indicated decline of number of passengers travel by the scheduled flights. As per the data in 2016, scheduled flights were available only between three destinations. A considerable number of passengers had travelled only between Ratmalana- China bay and Ratmalana- Palaly using scheduled flights. All scheduled flights destinations were more than 100 NM away from each other.

Lack of re-fuelling facilities, excessive traffic at Ratmalana, lack of navigational aids, security issues, high charges, poor runway and surrounding conditions are some of the difficulties faced by the domestic flight operators during their operations.

B. Aviation Demand Analysis - Liner- Regression

Population, runway length, airfares, total air travel time, scheduled convenience, flight frequency, destinations, competing landing facilities (water aerodrome), travel time, distance and cost by road transport (by taxi), and guest nights, were identified as the important factors that affect domestic aviation demand in Sri Lanka.

Liner regression analysis was employed to create the Model through which the demand for Kandy airfield was calculated. The best combination of explanatory variables was selected considering the minimum standard error, value of R square and significance. Predictors are the air distance between two airfields in nautical miles (D) and total guest nights in tourist hotel establishments in the region of two destinations (airfields) in thousands (GN). As per the outcome of the liner- regression analysis, a model was formulated for aviation demand.

$$PAX_{AB} = 4.6379 \times 10^{-9} \times GN_A^{0.599} \times GN_B^{0.568} \times D_{AB}^{3.776}$$

PAX_{AB} = No of passengers travel by scheduled flights in the year

GN_A = Total annual guest nights in tourist hotels at region A

GN_B = Total annual guest nights in tourist hotels at region B

D_{AB} = Air distance between A and B in NMs

GN_A and GN_B in 000'

The domestic passenger demand for scheduled flights for a runway in Kandy was estimated using the above model assuming the same operational conditions are valid for other airfields in the country. The demand was calculated only for the airfield which can facilitate MA-60 aircraft operations since the scheduled flights were done only by MA-60 in 2016. The demand between China bay-Kandy and Batticaloa-Kandy were estimated using same guest night data of Eastern tourist region.

Table 1. Aviation Demand for Scheduled Flights to a Runway in Kandy per Year/Month/Week

From	To	Demand		
		Yearly	Monthly	Weekly
Kandy	Rathmalana	116	10	2
Kandy	Katunayake	58	5	1
Kandy	Mattala	94	8	2
Kandy	Chinabay	176	15	4
Kandy	Batticalo	67	6	1
Kandy	Anuradhapura	46	4	1
Kandy	Hingurakgoda	15	1	0
Kandy	Palaly	427	36	9
Rathmalana	Kandy	119	10	2
Katunayake	Kandy	58	5	1
Mattala	Kandy	95	8	2
Chinabay	Kandy	174	14	4
Batticalo	Kandy	66	5	1
Anuradhapura	Kandy	44	4	1
Hingurakgoda	Kandy	14	1	0
Palaly	Kandy	386	32	8

Source: Created by the Researcher, 2017

According to the outcome of the analysis (Table 1), the maximum demand is 427 passengers per year from Kandy to Palaly. There is no demand for one scheduled flight per week between Kandy and any destination, even for a 15-passenger small aircraft. Between Kandy-Palaly, there would be 8-9 passenger demand per week. It showed no significant domestic aviation demand prevails for scheduled flights to- or from- Kandy.

If the demand is calculated even for other airfields which cannot facilitate MA-60 aircraft operations using the same model, there is a demand for scheduled flights between Koggala and Kandy (465 passengers from Koggala to Kandy per year). Therefore, Koggala could be identified as a potential market for domestic aviation.

C. Aviation Demand Analysis - Potential User Survey

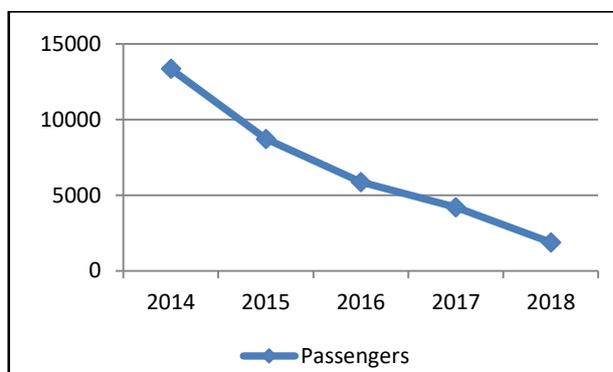
The outcome of the potential user survey signifies that the interest of the domestic operators for an airfield in Kandy is generally high, and the interests of 55% of operators are above average, but none of the operators are willing to base any of their aircraft in an airfield in

Kandy. Therefore, there is no aviation demand for a runway in Kandy to base the civil aircraft.

79% of domestic operators are interested on operating their aircraft in an airfield in Kandy, but most operators were not in a position to estimate the number of flights or the frequency of flight operations to an airfield in Kandy. It revealed that the interests of domestic operators on a runway in Kandy mainly depend on their aircraft types and their operations. Predicted types of aircraft for flight operations to a runway in Kandy would be small fixed-wing aircraft used for flying training such as Cessna. The majority of the operators would carry out training and charter flights at an airfield in Kandy. None of the operators had an interest to carry out scheduled flights to a runway in Kandy.

D. Aviation Demand Analysis - Trend Projection

The future passenger demand for scheduled flights was forecasted through trend projection method assuming that the impact of the factors and the trend of passengers will continue as in the past. As per the graph, it is estimated that the passengers for scheduled flights will decrease during next few years. A development of this situation cannot be expected without a change of other factors that influence the domestic aviation in Sri Lanka.



Graph 1. Number of Passengers' Forecast by Scheduled Flights

Source: Developed by the Researcher, Based on Secondary Data, 2017

It was found that the total numbers of domestic flight operations and the passenger movements have generally increased from 2010. Further, both total domestic passenger movements and the flight movements are expected to increase in the future as per the trend projection.

According to the present trends of domestic aviation sector in Sri Lanka, there is a higher tendency of improvements of demand for the float planes, which is also applicable to Kandy where two water aerodromes are available in close proximity of the city. Further,

helicopter charters provide the opportunity for travellers to land directly at their location with a limited flat ground of obstruction-free space and to have multiple visits. It may be more useful than a normal aircraft, for a hilly area such as Kandy.

E. Further Consideration for Construction of a Runway

There is no significant demand for domestic scheduled flights between Kandy and other airfields in the country and no demand to base the aircraft if there is a runway in Kandy. However, demand exist for charter flights and training flights for a runway in Kandy are needed to be calculated. Further, the relationship of the variables used to determine the aviation demand for scheduled flights may not be constant always, and may change according to other factors in the environment. Therefore, total domestic aviation demand analysis is required for further consideration of construction of the runway in Kandy.

Re-fuelling and ground handling facilities, advance navigational aids, pilot and passenger lounge areas with refreshments are identified during the study as essential facilities required for an airfield in Kandy.

According to the outcomes, which are the demand for domestic scheduled flights, and to base the aircraft if there is runway in Kandy, further consideration of a runway construction seems not worthy and viable. But the decision for further consideration of construction should be finalized after reviewing total domestic aviation demand and the impacts of the runway, including on domestic aviation.

IV. CONCLUSION

Analysing the aviation demand is an important pre-requisite to decide the construction of a new runway. Decision analysis was the method used for analysing aviation demand in this study, and the analysis was based on a combination of qualitative and quantitative techniques. The techniques used for analysing are regression analysis, potential user survey, and trend projection methods.

The study revealed that at present, no demand exists for scheduled flights to Kandy or to base the aircraft if there is a runway in Kandy. Further, historical data indicates continues decline of passengers for scheduled flights and show a decreasing trend in the recent future, but both total domestic passenger movements and the flight movements are expected to increase in the future. Nevertheless, the potential user-survey indicated a demand for charter flights and training flights for a runway in Kandy, which needs to be calculated through a scientific method. Further consideration of construction has to be decided after reviewing total domestic aviation demand and the impacts of the runway.

Findings of aviation demand will help the authorities for further consideration of the runway construction and help decision-makers and policy makers of the government transport sector for future developments. Anticipated or forecasted volume of traffic and passengers influence the aerodrome facilities, land requirements, and the configuration of runway, which will be useful for aerodrome planners for future applications. Further, findings will help domestic operators in making their marketing and operational strategies, and to understand the market and will provide useful information for stakeholders in the tourism industry and the transport sector. Findings of aviation demand will also help further studies on this subject area.

A. Recommendations

Recommendations were made based on the study findings in need of constructing a runway in Kandy. The potential market for an airport/airfield is to be identified and the demand for aviation services to be analysed at the planning stage. In addition, if available, national aviation plan and national interest are to be considered for analysis. Comprehensive study is to be done to analyse the total domestic aviation demand for a runway in Kandy before further consideration of the construction. In addition, it is recommended to carryout proper aviation demand analysis before any runway or airport development project.

An appropriate feasibility study and an Environmental Impact Assessment (EIA) should materialise before construction of a runway; further, Central Environmental Authority should be obtained. It is recommended to conduct an EIA for the runway in Kandy before further consideration of the construction.

A comprehensive study involving the influencing factors is to be done before commencing a capital project such as constructing a runway or an airport. Impact analysis should cover all areas such as social impacts, economic impacts, environmental impacts, aviation impacts, construction and operational impacts, and land use.

The Airport Master Plan for Kandy is to be developed and the approval of Civil Aviation Authority is to be obtained if the construction is going to be continued. An airfield configuration analysis is recommended to conduct before commencing any airport development project to identify the required infrastructure and other facilities.

The financial analysis should appraise the financial requirement and feasibility for a mega project such as a construction of a runway. Further, the project needs to have a reliable and viable financial allocation. Therefore, it is recommended to conduct proper financial analysis and viable financial allocation before further construction

of the runway in Kandy. An economic analysis should evaluate the least cost for implementation and identify the ways of achieving highest economic returns and benefits.

A suitable study with the contribution of professionals in the field regarding the land use is needed before allocating lands for constructions. If the construction to be suspended, a proper land-use study must identify viable utilizations of the land area already cleared for constructing the runway in Digana region. A suggested option of the researcher is to convert this area to a motor-racing track. Large-scale projects should commence after receiving appropriate approvals from relevant authorities (e.g. cabinet, parliament) as required.

In addition to the above, recommendations can be made in view of improving the domestic aviation sector in Sri Lanka based on the study findings. It is recommended to utilize Mattala airfield for flying trainings and to shift the flying training clubs/companies to Mattala. Refuelling facilities and pilot and passenger lounge area with refreshments are to be made available in all airfields in Sri Lanka to facilitate civil domestic flight operations. It is recommended to utilize available airfields in the country to base the aircraft and for domestic flight operations. The investors are to be encouraged to improve float plane sector, since the requirement of infrastructure development in water aerodrome is minimal. Helicopter operations are to be promoted as an important travel option to both leisure and business travellers, and therefore, it is recommended to develop more helicopter landing locations within the region of hill country as well as other regions in the country.

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