OPTIMIZING PASSENGER MOVEMENTS THROUGH AIRPORT TERMINALS

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Degree of Doctor of Philosophy

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Sri Lanka

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Thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Civil Engineering

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DECLARATION OF THE CANDIDATE & SUPERVISOR

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Abstract

Minimizing walking distances, waiting times and delays at critical service centers such as ticket counters, immigration, baggage claim and security checks and optimal spacing of other services or frictions such as shops, washrooms, food cabins and internet accesses within a terminal could contribute much towards passenger comfort. Knowledge regarding arrival and waiting patterns of passengers at mandatory service centers and other services helps model passenger flow through the terminal. This knowledge depends on airport location, the operating strategy of the terminal and the frictions placed in between mandatory service centers.

Existing simulation and analytical models for walking distances and waiting times are for specific use at one airport or one part of the airport only. They cannot be used elsewhere. Therefore, finding out flexible mathematical models for common use at all airport terminals is the main purpose of this research. The research concentrates on two main objectives, of which, the first is to develop mathematical models to optimize passenger flow through different servers and other facilities minimizing total waiting time at all mandatory service centers. The other objective is to evaluate the different terminal configurations and find the optimum terminal configuration with the least waiting time for passengers.

Data related to waiting time and service time at different mandatory service centers helped find placements for suitable frictions to be located before the mandatory service centers. Criteria developed for the purpose were means and variances of waiting times at mandatory service centers with and without frictions. If the mean waiting time at a mandatory service center without friction is less than that at a mandatory service center with friction, a friction before the mandatory service center gets rejected. Queuing theory helped fix suitable frictions before the mandatory service centers. These analytical solutions were verified using the Monte Carlo simulation using queuing theory.

Secondly, proper frictions to be placed before the gates in terminal configurations to minimize passenger delays were realized with the pier type terminal configuration, where the three pier type terminal configurations with frictions was considered for optimal terminal configuration to minimize passenger delays. The optimum terminal configuration to minimize passenger delays appeared to be the terminal with three piers holding an unequal number of gates. The developed models include the common features of all airport terminals and are capable of describing any terminal configuration.

- *Keywords:* Waiting time, Walking distance, Frictions, Terminal configuration, Simulation

DEDICATION

To,

My ever loving…

Parents,

Husband

&

Sister!!

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LIST OF ABBREVIATIONS

BIA - Bandaranaike International Airport

FIFO – First in – First out

CDF – Cumulative Density Function

AD – Anderson Darling

ANOVA – Analysis of Variance