



REVENUE TREATMENT IN BUS DISPATCHING

H.A.C. PERERA

This thesis was submitted to the department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirement for the Degree of Master of Science.

Supervised by
Professor Amal S. Kumarage

Department of Civil Engineering
University of Moratuwa
Sri Lanka

2007

91153



Abstract

Traditionally public transport has been perceived as the less desirable alternative to the car. The common argument of using public transport has not led to a significant increase in the usage of public transport. In order to convince people to leave their car at home, public transport must be at least as, desirable as driving a car. There are a number of ways of achieving this-reducing fares, introducing quality bus corridors etc. However the most effective strategy of doing this is to reduce the perceived unreliability of public transport, through an efficient bus scheduling system.

To make this dream come true, the bus scheduling is not the only criteria, which means scheduling, implementation, monitoring and self support of each person in this industry are most needed. As this industry is purely a business concern, without considering the operators revenue and the passenger demand the system cannot be improved. This thesis is intended to discuss some aspects on the revenue of operators and usefulness of them, when scheduling buses.

A good system for implementing effective bus scheduling systems should be described. This system uses every possible aspect relating to this service chain, ultimately to provide a coherent method with benefits down to the users. The end benefactor in this system is not only the investor but also the user of the system, which means the passenger.

LB/DON/30/08

REVENUE TREATMENT IN BUS DISPATCHING

H.A.C. PERERA

LIBRARY
UNIVERSITY OF MORATUWA, SRI LANKA
DEMUNARA

This thesis was submitted to the department of Civil Engineering of the University of Moratuwa in partial fulfilment of the requirement for the Degree of Master of Science.



University of Moratuwa, Sri Lanka
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

Supervised by
Professor Amal S. Kumarage

624 300
624 (048)

91153

**Department of Civil Engineering
University of Moratuwa
Sri Lanka**

July 2007

University of Moratuwa



91153

91153

DECLARATION

I declare that the work described in this thesis, except where otherwise stated, is entirely my own work and has not been submitted for a degree, at this or any other university.



H. A. C. Perera



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

UOM Verified Signature

Prof. Amal S. Kumarage
(Supervisor)

Abstract

Traditionally public transport has been perceived as the less desirable alternative to the car. The common argument of using public transport has not led to a significant increase in the usage of public transport. In order to convince people to leave their car at home, public transport must be at least as desirable as driving a car. There are a number of ways of achieving this-reducing fares, introducing quality bus corridors etc. However the most effective strategy of doing this is to reduce the perceived unreliability of public transport, through an efficient bus scheduling system.

To make this dream come true, the bus scheduling is not the only criteria, which means scheduling, implementation, monitoring and self support of each person in this industry are most needed. As this industry is purely a business concern, without considering the operators revenue and the passenger demand the system cannot be improved. This thesis is intended to discuss some aspects on the revenue of operators and usefulness of them, when scheduling buses.

A good system for implementing effective bus scheduling systems should be described. This system uses every possible aspect relating to this service chain, ultimately to provide a coherent method with benefits down to the users. The end benefactor in this system is not only the investor but also the user of the system, which means the passenger.



University of Moratuwa, Sri Lanka.

Electronic Theses & Dissertations

www.lib.mru.ac.lk

Acknowledgement

I would like to acknowledge all the advice and support given and patience shown by my supervisor **Prof. Amal S. Kumarage** throughout the course.

I thank **Dr.I.M.S.Sathyaprasad**, University of Peradeniya, for the valuable comments and suggestions throughout the work on this research.

I would also like to thank **Mr. Anuradha Piyadasa** for his kind help and the valuable discussions.

Some valuable comments on how to improve my study were given by **Mr. Ashoka Gunasekara**. I appreciate this and thank him very much.

Many thanks to **Miss Pradeepa Jayaratna** and **Miss Rasika Samankumari** for their help in completing this thesis.

My parents have provided a great deal of support throughout this period and I am grateful to them, for their understanding.

Finally, my thanks go to **Manori** for her untiring support, understanding and love. Her encouragement led to the completion of this thesis.



University of Moratuwa, Sri Lanka.

Electronic Theses & Dissertations

www.lib.mrt.ac.lk

Tables of Contents

Abstract	I
Acknowledgement	II
Table of Contents	III
List of Figures	V
List of Tables	VI
Annexes	VII
List of Symbols, Notations & Abbreviation	VIII
1.0 Introduction	1
1.1. Thesis Contribution.....	2
1.2. Importance of Current Public Transport Sector in Sri Lanka.....	2
1.3. Thesis Roadmap.....	5
2.0 Literature Review	6
3.0 Data Collection	11
3.1. Introduction.....	11
3.2. Type and Method of Data Collection	11
3.2.1. Passenger Loading Survey.....	11
3.2.2. Boarding and Alighting Survey.....	12
3.3. Area of Concerned in Data Collection	13
4.0 Theory Development	14
4.1. Introduction.....	14
4.2. Basic Measurements in Bus Operation.....	14
4.2.1. Bus Scheduling on Economic Criteria.....	15
4.3. Route Demand Data Fitting to Parabolic Curve	17
4.3.1. Method Formulation	17
4.4. Revenue of Bus Operation	20
4.4.1. Revenue Calculation Using Boarding & Alighting Survey Data	20
4.4.2. Determining Values for the Constants.....	23
4.4.3. Revenue from Loading Survey Data.....	24
4.4.4. Trip Revenue Ratio.....	25
4.5. Combination of Passenger Demand Curve and Revenue	26
4.6. Optimum Bus Operation Regarding Revenue and Cost.....	28
5.0 Case Study and Discussion	31
5.1 Introduction.....	31
5.2 Fitting Parabolic Curve to Selected Loading Survey Data	31
5.3 Revenue Calculation Using Boarding & Alighting Survey Data	35
5.3.1. Finding Values for the Constant α , β	36
5.3.2. Finding Values for the Constant γ	37
5.3.3. Revenue of Panadura Nugegoda Road.....	39
5.4 Combination of Demand Curve Equation and Revenue.....	42

5.5 Discussion.....	44
6.0 Conclusion.....	47
Annexes I	48
Annexes II	49
References	50



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

List Of Figures

Figure 2.1: Proposed Bus Dispatching Process (Piyadasa J.D.A.I., 2005).....	7
Figure 4.1: Typical Bus Route With n Number Of Major Stops (Halts).....	21
Figure 4.2: Typical Bus Route Consists of n-1 Number of Sections.....	22
Figure 4.3: Typical Demand Pattern of a Route.....	26
Figure 4.4: Optimum Headway of Bus Dispatching Based on Financial Revenue to the Operator (Piyadasa J.D.A.I., 2005).....	29
Figure 4.5: Optimum Bus Dispatching Headway (Piyadasa J.D.A.I., 2005).....	30
Figure 5.1: Demand Pattern of Moratuwa – Pettah Bus Route	34
Figure 5.2: B & A Pattern of Panadura – Nugegoda Bus Route.....	35
Figure 5.3: Variation of Value of γ	39
Figure 5.4: Average Demand Distribution (Part of the Curve)	44
Figure 5.5: Buses are Dispatched According to the Demand.....	45



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

List of Tables

Table 3.1: Details of routes where B & A survey was carried out.....	13
Table 5.1: Loading Survey Data in Route No 183	32
Table 5.2: Normal Equation in Matrix Form	33
Table 5.3: Sample B & A survey data for a trip in 183 route.....	35
Table 5.4: Revised Fare Table for year 2006.....	37
Table 5.5: Fare Increments between two consecutive fare stages	38
Table 5.6: Value for the Constant γ	39
Table 5.7: Different Trip Revenue Ratios in Different Loading Survey Locations...	41
Table 5.8: TRR Values for All 10 Routes	41



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

Annexes

Annex I Map of the Travel Corridors Selected from the B&A Survey	48
Annex II Route Number 183 with Loading Survey Location.....	49



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

List of Symbols, Notations & Abbreviation

CTB	–	Ceylon Transport Board
SLTB	–	Sri Lanka Transport Board
GDP	–	Gross Domestic Product
NTC	–	National Transport Commission
R_{avg}	–	Average Revenue
k_t	–	Trip Length Ratio
f_t	–	Bus Fare
D_t	–	Total Demand of a Route
$f(t)$	–	Equation of a Curve with respect to t
R_{avg}	–	Average Revenue
$Pass_{avg}$	–	Average Passenger
B & A	–	Boarding and Alighting



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk