

LB/DON/198/2016

~~CE 12/59~~

DCE 21/59

IMPLEMENTING CYCLE LANE FACILITIES IN EASTERN PROVINCE IN A SUSTAINABLE MANNER

LIBRARY
UNIVERSITY OF MORATUWA, SRI LANKA
MORATUWA

Vivekanandan Theebendran

118861L

Degree of Master in Engineering in *Highway and
traffic Engineering*

Department of Civil Engineering

University of Moratuwa
Sri Lanka

624-16
625+656(0+3)

University of Moratuwa



TH3186

UNIVERSITY OF MORATUWA
LIBRARY

ACCESSION NO.

March 2016

TH 3186
+ CD - ROAD

TH3186

Declaration of the Candidate and Supervisor

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degr e or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature

UOM Verified Signature

Date: 08.04.2016

The above candidate has carried out research for the Master under my supervision.

UOM Verified Signature

Signature of the supervisor.

Date: 20.04.2016

ACKNOWLEDGEMENT

I am glad to present this thesis for my Master degree in Highway & Traffic Engineering, University of Moratuwa, Sri Lanka. This report consists of the details of my research findings towards implementing cycle lane facilities in Eastern Province.

At the outset, I must thank the University of Moratuwa, for accommodated me to follow Master degree in Highway & Traffic Engineering. I must very much thankful to all the Lecturers guided me for developing myself for Master degree. Especially, Prof.J.M.S.J.Bandara, Supervisor for my Research, who gave me continuous guidance and worthy instructions. He was an excellent teacher and engaged his maximum efforts to complete the degree not only considering the theoretical matter also in practical matters.

I also wish to thank Prof.W.K.Mampearachchi, Course Coordinator, M.Eng in Highway & Traffic Engineering, for his valuable advice and guidance towards the successful completion of the master degree.

Finally, I do wish to thank all the Senior Engineers, Engineers and other staff of the Planning Division, Highway Designs Office and PRP2N Project division, RDA and all other well-wishers for their continuous support in paving my way towards this Post graduate qualification.

ABSTRACT

Commuting by bicycle is a sustainable transport strategy and has advantages over other modes of transport, both for the commuter and for society. The social cohesion that can bring through recreational opportunities also promotes wellbeing. A diverse range of people choose to cycle, including school-aged children, regular commuters, weekend recreational cyclists and sporting cyclists. Cycling does not emit greenhouse gas, cause air or water pollution or rely on fossil fuels. Road Development Authority (RDA) has taken a policy decision to incorporate a separate lane as cycle lane to encourage the non-motorized transport of this country. But it is observed that these bicycle lanes are not used for its intended purpose. Especially in Colombo area, there are very few bicyclists on the roads and bicycle lanes are always empty. So, it is seen that the bicycle lanes are used to overtake vehicles in wrong side, for illegal roadside parking etc. While the situation is such, Road Development Authority is planning to extend its new policy to the areas where there are higher numbers of cycle users. Trincomalee is one of the districts in Eastern province having higher numbers of cycle users and the terrain condition also well suited for cycling. More than 50% of the road users are identified as cycle users and almost 60% of car, three wheel & motorcycle trips are less than 4 kms, a distance that is easily cycled in less than 20 minutes. These data were collected during field observation. Although cycling is an option for many commuters, a considerable number of them choose to use other forms of transport. Especially school children & office staffs, they use three wheel or motorbike as transport mode. In order to underpin policies that promote commuting by bicycle, this research investigates the determinants for commuting to work, school or their other purposes and studies about the public opinion in existing road conditions to use bicycles and their concern in cycling facilities to be provided in the future road developments. A questionnaire survey was conducted among 200 road users in different part of Trincomalee district. Accordingly, it was understood that existing road conditions such as non-availability of continue route network dedicated for Cyclists, mixed traffic without proper safety measures and parking facilities discouraged the commuters to use bicycle as their transport mode and commuters in Trincomalee district are really willing to use as a sustainable transport mode for the short trips up to 4kms, if the cycle lane facilities are provided with safety and comfort.



TABLE OF CONTENT

	Page
Declaration of the Candidate & Supervisor	i
Acknowledgements	ii
Abstract	iii
Table of Content	iv
List of Figures	v
List of Tables	vi
List of Abbreviations	vii
List of Appendices	viii
1. Introduction	1
1.1. General	1
1.2. Problems and Research Objective	2
1.2.1. Problems identified	2
1.2.2. Objective of the study	2
2. Literature Review	3
2.1. Facility based infrastructure	6
2.1.1 On road (Separate lane) - Cycle lanes	7
2.2 Cycle network and Infrastructure	7
2.2.1 Bike riders behaviors when share the road	8
2.2.2 Drivers behaviors when share the road	8
2.3 Bicycle Rider Requirements	9
2.3.1 Smooth Surface	9
2.3.2 Space to Ride	10
2.3.3 Speed Maintenance	10
2.3.4 Sight lines	11
2.3.5 Connectivity	11
2.3.6 Information	11
2.4 Design aspects for Cycle Infrastructure	12
2.4.1 Design concept for Bicycle lanes	12
2.4.2 Cycle lane width	12
2.5 Intersection Treatment	15
2.6 Bike Boxes	18
2.7 Right Turn for Bicyclists	20
2.8 Necessity of Bicycle Parking Places	20
2.9 Identification and signs for the Cycle users	21
3. Location of the Area	24
4. Methodology	26
5. Data Analysis & Discussion	28
6. Conclusion & Recommendation	38
Reference List	41
Appendix A:	42

LIST OF FIGURES

	Page	
Figure 2.1	Modal share of cycling compared to Australia	5
Figure 2.2	Cyclist envelope	10
Figure 2.3	Options for Cyclist	14
Figure 2.4	Bicycle operating space	14
Figure 2.5	Intersection Lane Marking with a Stop Line in a Non Signalized Intersection	15
Figure 2.6	Intersection Lane Marking without a Stop Line in a Non Signalized Intersection	16
Figure 2.7	Intersection Lane Marking with a Stop Line in a Signalized Intersection	17
Figure 2.8	Recommended Bike Box Design	18
Figure 2.9	Bike Box in Portland	19
Figure 2.10	Cycle Only Turn Protected by a Splitter Island	20
Figure 2.11	Sheffield Stand with Cross Bar, Signing and Reflectorized Bands	21
Figure 2.12	Traffic signs for Cyclists	22
Figure 2.13	Road marking and Colour surface demarcated for cycle users	23
Figure 3.1	A part of road network in Trincomalee district	24
Figure 3.2	A View of Intersection at Sea View road	25
Figure 3.3	A Map of Intersection at Sea View road	25
Figure 5.1	Accident patterns of Bicyclists by Gender category in Trincomalee	28
Figure 5.2	Important criteria when proving new cycle routes	29
Figure 5.3	Mean values of the above criteria for providing new cycle lane	30
Figure 5.4	Safety concerns of cyclists when cycling on different provisions at any time of a day	31
Figure 5.5	Mean values of Safety concerns of cyclists when cycling at any time of a day	31
Figure 5.6	Safety concerns of cyclists when cycling on different provisions at off-peak time	32
Figure 5.7	Mean values of Safety concerns of cyclists when cycling on different provision at off-peak time	33
Figure 5.8	Effect of sharing space with other traffic category	34
Figure 5.9	Mean value for Effect of sharing space with other traffic category	34
Figure 5.10	Type of factors puts off cycling	35
Figure 5.11	Mean value for type of factors puts off cycling	35
Figure 5.12	Factors influence in Cycling more frequency	37
Figure 5.13	Mean value for factors influence in cycling more frequency	37

LIST OF TABLES

		Page
Table 2.1	Space occupied by each mode demonstrated with respect to the standing space required by the Bicycle	3
Table 2.2	Bicycle network features	8
Table 2.3	Design standards for lane width	13
Table 2.4	ADT data of A6 road corridor	13

LIST OF ABBREVIATIONS

Abbreviation	Description
RDA	- Road Development Authority
ADT	- Average Daily Traffic
LTA	- Land Transport Authority

LIST OF APPENDICES

Appendix	Description	Page
Appendix-A	Questionnaire Survey form on Cycle lane facilities in Eastern Province	42