

**DEVELOPMENT OF GUIDELINES TO IMPROVE THE TRANSPORT  
INFRASTRUCTURE TO ADDRESS THE MOBILITY OF BLIND AND  
VISUALLY IMPAIRED PEOPLE OF SRI LANKA**

R A M C RANASINGHE

(2010/2011 )



University of Moratuwa, Sri Lanka.  
Electronic Theses & Dissertations  
[www.lib.mrt.ac.lk](http://www.lib.mrt.ac.lk)

Master of Engineering in Highway and Traffic Engineering

Department of Civil Engineering

University of Moratuwa

Sri Lanka

February, 2014

## DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university to the best of my knowledge and belief and it does not contain any material previously published written or orally communicated by another person or myself except where due reference is made in the text. I also hereby give consent for my dissertation, if accepted, to be available for photocopying and for interlibrary loans, and for the title and summary to be made available to outside organizations.

.....

Signature of the Candidate

.....

Date

To the best of my knowledge, the above particulars are correct



.....

Signature of the Supervisor

University of Moratuwa, Sri Lanka.  
Electronic Theses & Dissertations  
[www.lib.mrt.ac.lk](http://www.lib.mrt.ac.lk)

.....

Date

## ACKNOWLEDGEMENT

It is my pleasure to pay sincere gratitude to my research supervisor, Dr W K Mampearachch who spent his valuable time throughout the study by giving instructions, guidance to complete a successful research.

I also wish to thank all Ceylon blind association for assisting me to find a mobility trainer. Mrs Kotalawala , mobility trainer of all Ceylon blind association who supported me by giving valuable contribution on mobility training is gratefully acknowledged. The members of Sri Lanka blind association helped me to conduct case study along Galle road and conduct the opinion survey and questionnaire survey. I also wish to thank their support.

I would like to thank Prof J M S J Bandara and Mr R M Amarasekara for their valuable comments and guidance to complete this thesis successfully.

Finally I thank organizers of Transport Research Forum, University of Moratuwa for giving me a great opportunity to present my research.

I also grateful to all post graduate students, officers of transportation engineering laboratory of University of Moratuwa who supported me to complete this thesis successfully.



University of Moratuwa, Sri Lanka.  
Electronic Theses & Dissertations  
[www.lib.mrt.ac.lk](http://www.lib.mrt.ac.lk)

## Abstract

Sight loss can affect a person's independence more than any disability. Unsurprisingly many people who lose their sight never go out unaccompanied after facing difficulties they encounter by going to various places by themselves. These difficulties are very often magnified in the absence of facilities for such community in the society. By introducing facilities on road infrastructure and public transport can substantially transform the livelihoods of blind and visually impaired people and their families. Lack of Accessibility and mobility will discourage this sector of society in finding employment, gain access to education and health services and also will limit their social and recreational activities. Therefore these people should be able to travel independently within their locality or in urban and suburban areas at least for their urgent needs using public transport. Though Sri Lanka has developed specifications for road infrastructure and public transport, they have not adequately addressed the requirements of blind and visually impaired people. The number of blind and visually impaired people has considerably increased due to thirty years of civil war.

Therefore study of the need of blind and visually impaired people is an urgent requirement. Once the requirements of blind and visually impaired people are identified it is necessary to provide solutions for them. My research will confine to the provision of such facilities for road infrastructure and public transport. The development of tactile paving guideline and road infrastructure development guidelines will address these issues.



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

Mainly four different methodologies were used for this research. Initially literature was reviewed by visiting standard guidelines of developed countries, laws and regulations in our country, previous research papers, websites related to this and relevant publications. This was followed by case study on the tactile guide way to identify the practical issues of existing tactile guide way developed and implemented by Colombo Municipal Council on Galle Road and to study response by blind and visually impaired people. An opinion survey was done for sample of blind and visually impaired people to identify their issues and get their feedback and suggestions and clarify issues noticed during the case study. On the outcome of opinion survey solution options were developed for questionnaire in order to identify their preferential option. Finally a mobility expert trainer was interviewed by me.

Based on decisions made by all these methodologies our own guidelines and specifications were developed for road infrastructure and bus transport. Guidelines developed under this project will create barrier free environment and help blind and visually impaired people to be more independent.

# TABLE OF CONTENT

Declaration	i
Acknowledement	ii
Abstract	iii
List of Content	iv
List of figures	vii
List of Tables	x
1 Introduction	1
1.1 Background	1
1.2 Research Needs	2
1.2 Objectives	3
1.3 Scope	3
2 Methodology	4
3 Literature Review	5
3.1 Definition of Disability in Sri Lanka	5
3.2 Current Situation	6
3.3 Laws and Regulations on Disability	7
3.4 Best Practices for Improved Mobility	9
3.5 Blindness and Visual Impairment	10
3.6 Visual Acuity	10
3.7 Mobility techniques	11
3.8 White Cane	12
3.9 Tactile Ground Surface Indicators (TGSI)	14
3.10 Warning Tactile Indicators	15
3.11 Directional Tactile Indicators	16
3.12 Visual Contrast of Tactile Paving	17
3.13 Material of Tactile	19
3.14 Minimum width of Paving	20
3.15 Obstacles in the Foot Walk	21
3.16 Signage	22
3.17 Foot Walks	29

3.18	Rest Areas	31
3.19	Road Crossings	33
3.20	Kerb Ramps	39
3.21	Controlled Pedestrian Crossings	49
3.22	Bus Stops	55
3.23	Case Study done by undergraduate engineering students of University of Moratuwa	58
3.23.1	Benefits of the facility	58
3.23.2	Negative Outcomes	59
3.23.3	Suggestions	
4	Case Study	60
4.1	Background	60
4.2	Case Study conducted under this research of Bambalapitiya – Kollupitiya Section.	60
4.3.1	Difficulty to identify the texture of tactile and surrounding paving blocks.	61
4.3.2	Minimum Depth of Tactile Warning	62
4.3.3	By-Road Crossings	62
4.3.4	Bus Stops.	63
4.3.5	Covers of utility Service Chambers and Road Furniture	64
4.3.6	Maintenance	65
4.3.7	Consistency	66
4.3.8	Pelican Crossing	67
4.3.9	Street Lighting	67
4.3.10	Street furniture and Surrounding	68
5.	Questionnaire Survey	69
5.1	Introduction	69
5.2	Questionnaire Survey	69
5.2.1	Preparation of Questionnaire	67
5.3	Analysis of Results	69
5.3.1	Findings of Opinion Survey	69
5.3.2.	Road Infrastructure	73

5.3.3.	Travel by Bus	73
5.3.4.	Age Distribution	73
5.3.5	The Second Questionnaire Survey	73
5.3.6	Employment Detail	74
5.3.7	Modes of Transport	75
5.4	The Questionnaire Survey	79
5.4.1	Findings of Questionnaire Survey	80
5.4.2	Summary of Questionnaire Survey	88
6.	Experience of Mobility Trainer	90
7.	Problem Identification and development of Guidelines	92
7.1	Objectives	92
7.2	Basis of Guideline	92
7.3	Guide line for Road Infrastructure Development for blind and visually impaired people.	94
7.4	Guideline for bus transport to address the issues face by blind and visually impaired people.	99
7.5	Tactile Paving Guideline	103
7.6	Design Principles	104
7.7	Warning Tactile Indicators	105
7.8	Audible Tactile Traffic Signal	106
7.9	Maintenance	110
7.10	Tactile Paving Arraignments	114
8	Conclusion	117
	List of References	121

## LIST OF FIGURES

Figure: 3.1	Person with Disability	5
Figure: 3.2	Causes for Disability	5
Figure 3.3	Causes for the Blindness	6
Figure 3.4	Essential elements for good access practice	9
Figure 3.5	Types of Grip	12
Figure 3.6	Height of the Cane	12
Figure 3.7	Folding Type White Cane	12
Figure 3.8	Tactile warning indicators	15
Figure 3.9	Directional Tactile indicators	16
Figure 3.10	Colour Wheel	18
Figure 3.11	Branching off Tactile Guide way	20
Figure 3.12	Contrasting Colour Combinations	22
Figure 3.13	International Symbol of Accessibility	23
Figure 3.14	Signage	24
Figure 3.15	Height of sign boards	25
Figure 3.16	Lettering Sizes	26
Figure 3.17	Character width and Height	27
Figure 3.18	ID Pole with Tactile Signage	28
Figure 3.19	Footwalk Minimum Dimensions	29
Figure 3.20	Footwalk Minimum Width	30
Figure 3.21	Grating on the Footwalk	31
Figure 3.22	layout of a resting place	31
Figure 3.23	Layout of Crossing	34
Figure 3.24	Raised Pedestrian Crossing	34
Figure 3.25	Correct Design and Orientation of Kerb Ramp	36
Figure 3.26	Crossing with Island	37
Figure 3.27	Raised pedestrian crossings	39
Figure 3.28	Standard Kerb Ramp	40
Figure 3.29	Built up Kerb Ramp	41



Figure 3.30	Street Intersection	41
Figure 3.31	Kerb Ramp at drop off area	42
Figure 3.32	Kerb Ramp at parking Area	42
Figure 3.33	Kerb Ramp at Diagonally Crossing	43
Figure 3.34	Kerb Ramp at continuously wrapped around Corner	44
Figure 3.35	Typical kerb ramp	46
Figure 3.36	Bottom Level Landing	47
Figure 3.37	Two kerb crossing- Kerb radius 1.5m	47
Figure 3.38	Two kerb crossing- Kerb radius 3m	48
Figure 3.39	Full quadrant kerb crossing	48
Figure 3.41	Audible tactile traffic signal	50
Figure 4.1	Case Study	58
Figure 4.2	Warning tactile at road crossing	60
Figure 4.2	Bus Stop	61
Figure 4.3	Parked vehicles	62
Figure 4.4	Utility Covers on the tactile path	63
Figure 4.5	Damaged Tactile	64
Figure 4.6	Pelican Crossing	65
Figure 5.1	Opinion Survey	68
Figure 4.2	Sample	69
Figure 4.3	Blindness category of the sample	69
Figure 5.4	Civil Status	70
Figure 5.5	Age group of the sample	71
Figure 5.6	Travel Frequencies	72
Figure 5.7	Travel Modes	73
Figure 5.8	Questionnaire Survey	78
Figure 5.9	Bus Stop ID pole with Tactile Sign	79
Figure 5.10	Marking of Street Furniture with colour contrast Material	80
Figure 5.11	Contrast colours at steps	82
Figure 5.12	Interior of the bus with contrast colours	82
Figure 5.13	Contrast colourstrip at steps	83

Figure 6.1	Mobility Trainer (The Lady in the Picture)	86
Figure 7.1	Colour combination with contrast	92
Figure 7.2	Maps and Information panels	93
Figure 7.3	Visible Character height and width	93
Figure 7.4	Tactile warning indicators	102
Figure 7.4	Colour Wheel	104
Figure 7.5	Colour combination with contrast	104
Figure 7.6	Main Road Crossing with Tactile Guided FootWalk	110
Figure 7.7	Main Road Crossing without Tactile Guided FootWalk	111
Figure 7.8	By - Road Crossing with Tactile Guided FootWalk	112
Figure 7.9	By - Road Crossing without Tactile Guided FootWalk	113
Figure 7.10	Bus stop with tactile guide way	114
Figure 7.11	Bus stop without tactile guide way without bus shelter	115
Figure 7.12	Bus stop without tactile guide way with bus shelter	116



University of Moratuwa, Sri Lanka.  
 Electronic Theses & Dissertations  
[www.lib.mrt.ac.lk](http://www.lib.mrt.ac.lk)

## LIST OF TABLES

Table No : 3.1	Viewing distance and Character Height	27
Table 3.2	Maximum Walking Distance	31
Table 3.3	Dimension of Kerb Ramp	36
Table 5.1	Travel Frequencies	76
Table 5.2	Preference to identify the bus stop	78
Table 5.3	Identification of Road Crossing	78
Table 5.4	Identification Obstacles in the Foot Walk	79
Table 5.5	Identification of Steps, Entry point and Seat of the Bus	81
Table 5.6	Preference to enter and exit of the Bus	81
Table 5.7	Method of payment	82
Table 5.8	Priority for tactile Guide line facilities	82
Table 5.9	Best Method to Get New Information	82



University of Moratuwa, Sri Lanka.  
Electronic Theses & Dissertations  
[www.lib.mrt.ac.lk](http://www.lib.mrt.ac.lk)