DEVELOPMENT OF A GUIDELINE FOR DESIGNING ECONOMICAL AND EFFECTIVE RETROFIT LED STREET LIGHTING SYSTEM FOR SRI LANKA

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Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa
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Thesis/Dissertation submitted in partial fulfilment of the requirements for the degree Master of Science in Electrical Installation

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree 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.

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

Signature of the supervisors: Date:

Prof. N.K. Wickramarachchi

Signature of the supervisors: Date:

Dr. W.D.A.S. Rodrigo

DEDICATION

I dedicate my M.Sc. research dissertation to my beloved parents and my husband for their support given throughout my life.

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L. W. N. Muthuransi

ABSTRACT

Nowadays most of the conventional type street lights are been converting to LEDs (Light Emitting Diodes). But there are no proper criteria or standardize methods to replace these conventional type street lamps to LEDs. Only energy saving aspect is garnering more attraction by the governments. But quality aspects like glare, uniformity ratios and color rendering should also be addressed. Otherwise it will not meet the safety and visibility needs of the road users which is the utmost objective of street light designing.

The objective of this thesis is develop a guideline for designing economical and effective retrofit LED street lighting system for Sri Lanka. According to EN 13201-2:2015 'Road lighting - Part 2: Performance requirements standard, lighting classes were defined by a set of photometric requirements aiming at the visual needs of road users by considering the road categories, number of lanes and street light installation patters in Sri Lanka. Then minimum wattage/ lumen output, ideal light distribution type, luminaire mounting height, overhang and slope angle which should be used when replacing conventional type luminaires were decided for all road categories through a computer simulation process.

It was noticed that pay-back period is long due to the cost of LED luminaire and arm modification. Also when we are trying to meet the standard luminance and illumination levels to a road which is having very poor lighting conditions, the cost becomes high. The prices of the LED luminaires are gradually decreasing and therefore lower price levels can be expected in the future and it will reduce these long payback periods. Though these projects have somewhat higher pay-back periods, they are still viable due to energy saving and maintenance cost saving compared to conventional type street lights.

Hence when implementing these kinds of public projects investment cost should not be the only reason that should be considered. The safety of road users, upgrade the quality of life by promotion of business activities during the night hours should also be addressed.

Keywords: LED, Street Light, Retrofit, EN 13201, Lighting Class, Dialux 4.12 Software, Pay-back, Net Present Value

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LIST OF ABBREVIATIONS

Abbreviation	Description
LED	Light Emitting Diode
CEB	Ceylon Electricity Board
GWh	Giga Watt hour
RCL	Regional Center for Lighting
CFL	Compact Fluorescent Lamp
ADB	Asian Development Bank
LECO	Lanka Electricity Company (Pvt) Ltd
CRI	Colour Rendering Index
CT	Colour Temperature
HPS	High Pressure Sodium
NPV	Net Present Value
RDA	Road Development Authority
PUCSL	Public Utility Commission of Sri Lanka
kWh	kilo Watt hour
W	Watt
cd	candela
m	meter
lm	lumen
L	Luminance or brightness
L_{av}	Average luminance
Uo	Overall Uniformity
Ul	Longitudinal Uniformity
TI	Threshold Increment
SR	Surround Ratio
CIE	Commission Internationale de l'Eclairage
IES	Illuminating Engineering Society
ANSI	American National Standards Institute
BIS	Bureau of Indian Standards

IESNA	Illuminating Engineering Society of North America
PHP	Hypertext Preprocessor

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