

**EVALUATION OF COST EFFECTIVENESS OF  
PERFORMANCE BASED  
MAINTENANCE CONTRACT**



R.M.N Thennakoonwela  
University of Moratuwa, Sri Lanka.  
Electronic Theses & Dissertations  
www.lib.mrt.ac.lk **08/8855H**

**MASTER OF ENGINEERING IN HIGHWAY  
& TRAFFIC ENGINEERING**

Department of Civil Engineering

University of Moratuwa  
Sri Lanka

February 2011

## Declaration

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

Signature:



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

Date:

“I have supervised and excepted this is thesis for the submission of the degree”

Signature of the supervisor:

Date:

## **ABSTRACT**

Road authorities around the world have been innovating and finding ways to cope with the high cost of road network maintenance, the growing demands of road users and the changing traffic type and volume. A well maintained road is needed to make the network sustainable for future generation.

The aim of this study is to evaluate the cost effectiveness of performance based maintenance contract for Provincial roads in Sri Lanka.

Four Type of maintenance methods were analyzed. Maintenance cost and condition of the road in each category were analyzed.

It was found that Performance Based maintenance contract method performed well low cost and good road condition. The road condition is maintained at good condition relative to the other method with low maintenance cost. And it was also founded that developed formula can be used for the road, when the overall damage percentages of the distress are given.

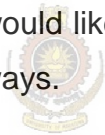
## ACKNOWLEDGEMENT

I would like to express my deepest gratitude to the Supervisor, **Dr: W.K. Mapearachchi**, for all his guidance and patience throughout the course of this research.

I also would like to thank the evaluation committee for their suggestions and comments. I further wish to thank the staff member of transport Engineering Division for their support to prepare this thesis.

I also thank provincial Road Development authority (W.P)for sponsoring me to follow this course of studies and continuous support to carry out research work.

Finally I would like to thank my family members for helping to carryout the research in many ways.



University of Kelaniya  
Electronic Theses & Dissertations  
[www.lib.mrt.ac.lk](http://www.lib.mrt.ac.lk)

**EVALUATION OF COST EFFECTIVENESS OF  
PERFORMANCE BASED  
MAINTENANCE CONTRACT**

By

**R.M.N Thennakoonwela**

Supervise by

**Dr.W.K. Mapearachchi**



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

The Dissertation Was Submitted To The Department Of Civil Engineering Of The University Of Moratuwa In Partial Fulfillment Of The Requirement For The Degree Of The Master Of Engineering In Highway & Traffic Engineering

Department of Civil Engineering

University of Moratuwa

February 2011

## TABLE OF CONTENTS

CHAPTER 01 .....	01
Introduction .....	01
1.0 Performance based maintenance contract .....	01
1.1 Importance of road maintenance .....	02
1.2 Type of maintenance .....	04
1.3 Annual maintenance budgets.....	05
1.4 Implementation of Maintenance Program .....	07
1.5 Main contract methods .....	08
1.6 Monitoring of performance based contract .....	10
1.7 Bidding process .....	12
1.8 Problem Statement .....	13
1.9 Objectives .....	13
1.10 Scope of the report .....	13
CHAPTER 2 .....	14
Literature Review .....	14
2.1 History of the performance based maintenance contact.....	14
2.2 Main reasons for implementing performance contracts .....	16
2.3 Main characteristics of performance contracts.....	16
2.4 Implementation.....	22
2.5 Best practice in Performance based maintenance Contract in world. ....	29
2.5.1 National road network in Uruguay .....	29
2.5.2 City of montevideo .....	29

2.5.3 Chad.....	30
2.5.4 Popayan Colombia. ....	31
2.6 Performance base maintenance system experience in Western Province .....	33
2.6.1. Direct labor.....	33
2.6.2 Maintenance contract System.....	33
2.6.3 Performance based maintenance work (contract).....	33
2.6.4 Performance based (direct labor) .....	34
2.7 Compression of performance standers and responsetime .....	36
2.7.1 Poth hole.....	36
2.7.2 Edge repair .....	36
2.7.3 Surface Defects.....	36
2.7.4 Contract Period.....	37
2.7.5 Selection of contractors .....	37
<b>CHAPTER 3 .....</b>	<b>38</b>
<b>Review Of Road Maintenance Of Sri Lanka .....</b>	<b>38</b>
3.1 Road network in Sri Lanka.....	38
3.1.1 Road development authority .....	38
3.1.2 Provincial council/ road development authority .....	39
3.1.3 Municipal council, Urban council .....	39
3.1.4 Pradesiya Saba And Other Roads.....	40
3.2 Funds for road maintenance .....	41
3.3 Maintenance of Provincial Road Network.....	42
3.4 Maintenance methods in western provincial road in Sri Lanka .....	43



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

CHAPTER 4 .....	46
Methodlogy .....	46
4.1 Case A – Evaluation .....	46
4.1.1 Direct labour normal maintenance .....	46
4.1.2 Normal maintenance contract.....	47
4.1.3 Performance based contract.....	47
4.1.3.1 Patching of potholes .....	49
4.1.3.2 Shallow pothole .....	49
4.1.3.3 Medium Pothole .....	50
4.1.3.4 Deep Pothole .....	50
4.1.3.5 Edge repair .....	50
4.1.3.6 Surface defect .....	50
4.1.4 Performance based direct labour .....	51
4.2 Road Condition Evaluation .....	51
4.5 Road Condition Rating Analysis.....	52
CHAPTER 5 .....	54
Field Data Collection For Maintenance Cost.....	54
5.1 Direct Labor Normal Maintenance .....	56
5.2 Normal Maintenance (Contract /Program).....	57
5.3 Performance base maintenance contract (package) .....	57
5.4 Performance based maintenance contract direct labor unit.....	58
5.5 Field Data Collection – Damage Percentage. ....	62
5.6 Comparison of Pavement Condition. ....	67
5.7 Compression of rating and costing.....	68



CHAPTER 6 .....	69
Conclusion and Recommendation.....	69
6.1 Summary .....	69
6.2 Conclusion and Recommendation.....	70
Reference.....	71
APPENDIX.....	73
1. Inspection Report Munagama Millewa Road .....	73
2. Inspection Report Wewala Yalagala Road .....	74
3. Inspection Report Werahena Gangabada Road .....	75



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

## LIST OF FIGURES

Figure 3.1 Maintenance annual allocation for past 10 years in Western Province .....	44
Figure 5.1 Direct labour maintenance cost during four month .....	60
Figure 5.2 Contract maintenance cost during four month.....	61
Figure 5.3 Performance base maintenance cost during four month.....	61
Figure 5.4 Performance base direct labour maintenance cost during four month .....	62
Figure 5.5 Road condition index vary with the month in each maintenance method .....	67
Figure 5.6 Maintenance Cost vary with the month in each maintenance method .....	68



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

## LIST OF TABLES

Table 1.1 Comparisons Of Contracts Conventional And Performance Base Method. ....	9
Table 1.2 General Specifications of Performance Contract.....	11
Table 2.1 Performance Indicators in Latin America.....	18
Table 2.2 Contract Standards and response times used in New Zealand .....	19
Table 2.3 Evaluation Criteria and Weights Applied for the Award of the Performance Contract of Washington D.C. ....	26
Table 2.4 Performance Standards and response time used in Western Provincial Roads.....	35
Table 3.1 Road maintenance method, allocation, road length, and improved road length in each province in Sri Lanka .....	43
Table 4.1 Maintenance standard introduced by Provincial Road Development Authority in Western Province. ....	48
Table 4.2 Selection of Rating for damage percentages .....	52
Table 5.1 Road inventory data for selected roads .....	55
Table 5.2 2010 Cost Summary – for 2 Km Length in Rupees for Roads A,B,C .....	56

Table 5.3 Cost Summary for 2km Length in Rupees for Roads D,E,F.....	57
Table 5.4 Cost Summary 2009 for 2 km Length In Rupees for Roads G,H,I.....	58
Table 5.5 2010 Cost summary for 2km Length in Rupees for Roads J,K,L.....	58
Table 5.6 Cost Summary for all A,B,C,D,E,F,G,H,I,J,K,L roads in Rupees...	59
Table 5.7 Variables entered /removed .....	63
Table 5.8 Model Summary.....	63
Table 5.9 Anova.....	64
Table 5.10 Coefficient.....	64
Table 5.11 Rating calculation for each method & each month.....	65
Table 5.12 Rating calculation for each method and each month.....	66

