

APPLICATION OF LOW-VOLUME ROAD MAINTENANCE MANAGEMENT SYSTEMS IN NEW ZEALAND TO THE PHILIPPINES

A thesis submitted in partial fulfillment of the
requirements for the Degree
of Master of Engineering in Transportation
in the University of Canterbury

by

Romelda Abat-Bangasan

Department of Civil Engineering
UNIVERSITY OF CANTERBURY
Christchurch, New Zealand

2006

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 generations. Improving road maintenance management in the Philippines, based on New Zealand experience, is the goal of this research with the theme of managing the change from method-based specifications to the adoption of performance-based specifications for unsealed low-volume roads.

The New Zealand Local Government Act 2002 prescribes the requirements for the provision, operation, and management of the local road network, consistent with the Land Transport Management Act 2002 and the New Zealand Land Transport Strategy. The maintenance management system used by New Zealand road controlling authorities (RCAs) was determined by survey and a profile of RCAs that have adopted performance-based specifications was established. RCAs that adopted performance-based specifications had employed asset managers, used the Road Asset Maintenance Management (RAMM) system as an asset management tool, engaged consultants for specialised skills, employed more engineers, had highly developed performance specifications, conducted customer surveys, and had more resources in terms of rates and revenues than RCAs that had not adopted performance-based specifications.

The proposed performance-based specifications for sealed and unsealed roads were also presented in this thesis.

The Department of Public Works and Highways of the Philippines has implemented three long-term performance-based maintenance pilot projects, all completed by 2005. The lessons learned from the pilot projects, together with the New Zealand survey results will guide road authorities in the Philippines to improve the implementation of future long-term performance-based maintenance contracts (LTPBMC) on national roads, and possibly apply the same to low-volume roads.

Acknowledgement

I take honour and pride in accomplishing this thesis which I never thought I am capable of doing. It was difficult and challenging, but in the end, I know it was worth it.

First and foremost, I would like to thank God for giving me wisdom, strength and courage to face the daily challenges of life. Without Him, I can do nothing.

My sincerest gratitude goes to the New Zealand Agency for International Development (NZAID) for the scholarship to undertake postgraduate studies at the University of Canterbury.

I would like to give my sincere thanks to Dr Alan Nicholson, my senior supervisor, for his advice, guidance and logistical support. I am very grateful to a remarkable man, who has been instrumental to achieving my goal, Dr Robert A. Douglas, my technical supervisor. I consider myself very lucky to be one of his supervisees. I learned a lot from him, from writing styles, grammar, organising my report, time management, anecdotes about his professional career, and simple lessons in life. I admire the way he does his job; straightforward, dedicated and well-organised.

Thank you to the Department of Civil Engineering, University of Canterbury staff, Louise Barton, for helping me print the survey questionnaires and envelopes, and Belinda Lansley for printing letters to my interviewees and other clerical services. Thank you to the Transportation Group in Civil Engineering, for the experience and insights shared during our group meetings. I would also like to thank Dr Bryan Pidwerbesky for his time and for sharing his views during the conception of this study. Thank you to the road maintenance staff of Fulton Hogan Ltd. Canterbury for providing samples of performance-based specifications used in the study.

Adjusting to life in New Zealand was complicated, but it was made easy because of the assistance and pastoral care by the staff of the University of Canterbury International Student Support (ISS). Thank you to Gareth Morgan, my former student adviser, who from day one was there to guide me until he left ISS. A special thank you goes to Eunice McKessar, my current student adviser, for being always there to talk to, a friend, a confidant, and a problem solver; and to Maree Thomas who patiently listens to my problems and acts on my requests. I will never forget the warm smiles that greet me every time I go to ISS. Thank you to the rest of the ISS staff, Bex, Jonie, and Sarah.

I am very grateful to the Department of Public Works and Highways for giving me the opportunity to undergo postgraduate studies. I would like to thank DPWH Secretary Hermogenes E. Ebdane, Jr. and DPWH staff who supported this endeavour. Thank you to Dir. B Elizabeth Yap, Diane Wacker, and Engr. Ernante Antonio, for sharing their time and ideas during the interviews. Thank you also to Dir. Luis A. Mamitag, Jr., Engr. Edwin Fortes, Elizabeth P. Pilorin, and Marilou H. Tuñgol, for their efforts in providing relevant information for this work. Thank you to the DPWH-AMMS staff, DPWH-CAR Regional Office staff, and the NEDA scholarship committee for helping me process my papers. I wish to express my

sincere appreciation to District Engineer Nerie D. Bueno of the Baguio City District Engineering Office, and the BCDEO staff for their support and encouragement.

To the current and former Filipino NZAID students and Filipinos in New Zealand especially in Christchurch and Lincoln, thank you very much for making me feel at home. I am also thankful to all my friends from Malaysia, Singapore, Bhutan, France, Thailand, New Zealand, Vietnam, China, Germany, Solomon Islands, Tonga, Canada, and USA for helping cope with University life, cheered me up and kept me sane. Thank you also to the Catholic Tertiary Chaplaincy team for the spiritual guidance they have given me.

This thesis is dedicated to my better-half, Severino, whose unceasing love inspired and encouraged me to carry-on with this endeavour. To Papa and Mama, thank you so much for your prayers, you may be far away in Canada but still, I feel you close to my heart. The same goes to my in-laws, my siblings, the rest of my family, and friends in the Philippines and Canada.

CHEERS!

Table of Contents

ABSTRACT	II
ACKNOWLEDGEMENT	III
TABLE OF CONTENTS	V
LIST OF TABLES	VIII
LIST OF FIGURES	IX
ABBREVIATIONS AND ACRONYMS	X
1 GENERAL INTRODUCTION	1
1.1 INTRODUCTION	1
1.2 BACKGROUND	3
1.3 CONCEPTUAL FRAMEWORK (JUSTIFICATION)	4
1.4 OBJECTIVES OF THE STUDY	4
1.5 SCOPE AND LIMITATIONS OF THE STUDY	5
1.6 METHODOLOGY	5
1.6.1 Review of New Zealand Local Government Act 2002	5
1.6.2 Survey of New Zealand Road Controlling Authorities	6
1.6.2.1 Road Controlling Authorities	6
1.6.2.2 Survey Questionnaire	6
1.6.2.3 Grouping of Road Controlling Authorities	7
1.6.2.4 Contributing Factors	7
1.6.3 Review of Maintenance Management Systems in the Philippines	7
1.6.4 Comparison of Performance-based specifications	7
1.7 REFERENCES:	8
2 THE ROAD NETWORKS IN NEW ZEALAND AND THE PHILIPPINES ..	9
2.1 INTRODUCTION	9
2.2 PHILIPPINE ROAD NETWORK	9
2.2.1 Reforms	13
2.3 NEW ZEALAND ROAD NETWORK	17
2.4 COMPARISON	20
2.4.1 Road Authorities	20
2.4.2 Road Statistics	20
2.5 REFERENCE:	22
3 NEW ZEALAND LOCAL GOVERNMENT ACT 2002	23
3.1 INTRODUCTION	23
3.2 THE LOCAL GOVERNMENT ACT 2002	23
3.3 REFERENCES:	26

4 MAINTENANCE MANAGEMENT SYSTEMS	27
4.1 INTRODUCTION.....	27
4.2 METHOD-BASED SPECIFIED VS. PERFORMANCE-BASED SPECIFIED MAINTENANCE CONTRACTS.....	27
4.2.1 Method-Based Specified Maintenance Contracts	27
4.2.2 Performance-Based Specified Maintenance Contracts	28
4.2.3 Advantages of Performance Specified Maintenance Contracts	28
4.3 PERFORMANCE-BASED MAINTENANCE CONTRACTS IN NEW ZEALAND.....	30
4.3.1 Evolution of Performance-Based Maintenance Contracts	30
4.4 PERFORMANCE-BASED MAINTENANCE CONTRACTS IN THE PHILIPPINES....	31
4.4.1 Evolution of Performance-Based Maintenance Contracts	31
4.5 REFERENCES:	33
5 SURVEY OF NEW ZEALAND ROAD CONTROLLING AUTHORITIES .34	
5.1 INTRODUCTION.....	34
5.2 CONTRIBUTING FACTORS IN THE ADOPTION OF PERFORMANCE-BASED SPECIFICATIONS	36
5.2.1 Internal Contributing Factors	38
5.2.1.1 Asset Managers	38
5.2.1.2 Consultants	39
5.2.1.3 Road Asset Maintenance Management.....	40
5.2.1.4 Customer Surveys	40
5.2.1.5 Specifications	41
5.2.1.6 Evaluation of performance of contractor	43
5.2.2 External Contributing Factors	44
5.3 REFERENCES:	48
6 TRANSITION – MANAGING CHANGE.....	50
6.1 INTRODUCTION.....	50
6.2 INTERNAL FACTORS	51
6.2.1. Asset Managers	51
6.2.2 Consultants.....	51
6.2.3 Road Asset Maintenance Management.....	52
6.2.4 Customer Surveys	54
6.2.5 Specifications	54
6.3 EXTERNAL FACTORS	56
6.4 POLICIES AND REFORMS.....	59
6.5 FUNDING	60
6.6 REFERENCES:	63
7 COMPARISON OF PERFORMANCE-BASED SPECIFICATIONS IN NEW ZEALAND AND THE PHILIPPINES	65
7.1 INTRODUCTION.....	65

7.2	ELEMENTS OF A PERFORMANCE-BASED SPECIFICATION	66
7.2.1	Scope of Work	66
7.2.2	Performance Criteria	66
7.2.3	Response Times	66
7.2.4	Traffic Management.....	67
7.2.5	Environmental Management	67
7.2.6	Basis of Payment.....	67
7.2.7	Construction Methods or Proposed Methods of Repair.....	67
7.2.8	Materials.....	67
7.2.9	Equipment	68
7.2.10	Testing Requirements	68
7.3	PERFORMANCE-BASED SPECIFICATIONS IN NEW ZEALAND AND THE PHILIPPINES.....	68
7.4	PERFORMANCE SPECIFICATIONS	72
7.4.1	Sealed Roads	72
7.4.2	Unsealed Low-Volume Roads	78
7.5	REFERENCES:	80
8	CONCLUSION.....	81
8.1	ACCELERATORS AND IMPEDING FACTORS USING PERFORMANCE-BASED SPECIFICATIONS	81
8.2	PROPOSALS FOR PERFORMANCE-BASED SPECIFICATIONS	84
	APPENDIX 1	85

List of Tables

Table 2.1. Road statistics.....	21
Table 5.1. RCA grouping.....	35
Table 5.2. Contributing Factors.....	37
Table 5.3. Values of internal contributing factors based on survey.....	41
Table 5.4. Values of contributing factors using the mean.....	45
Table 5.5. Values of contributing factors using the median.....	45
Table 5.6. Values of contributing factors using midway between the minimum and maximum.....	46
Table 5.7. Ranking the contributing factors using three options.....	46
Table 7.1. Key Performance Measures for Transit New Zealand's Performance-Based Specified Maintenance Contracts.....	70
Table 7.2. Some Selected Operational Performance Measures for Transit New Zealand's PSMC Contracts.....	73
Table 7.3. Performance Specifications for PSMC Pilot Projects in the Philippines.....	74
Table 7.4. Operational Performance Measures for Unsealed Low-volume roads.....	79

List of Figures

Figure 2.1. Philippine National Road Network.....	10
Figure 2.2. Paved National Road.....	11
Figure 2.3. Unsealed Low-volume Road.....	12
Figure 2.4. New Zealand's State Highway Network	18
Figure 2.5. Well maintained New Zealand state highway.....	19
Figure 2.6. Well maintained New Zealand Unsealed low-volume road.....	19
Figure 4.1. Risk Distribution.....	29
Figure 4.2 Value Chain.....	30
Figure 5.1. Reported duties of personnel in-charge of road maintenance.....	39
Figure 5.2. Contract Specifications.....	42
Figure 5.3. How specifications were developed.....	42
Figure 5.4. Frequency of revisions in specifications.....	43
Figure 5.5. Evaluation of contractor's work.....	44

Abbreviations and Acronyms

- **ADB** – Asian Development Bank
- **BIIPs** – Business Improvement Implementation Projects
- **BOM** – Bureau of Maintenance (Philippines)
- **CAAC** – Complaints and Action Center
- **CPM** – Contract Performance Measures
- **CQP** – Contract Quality Plan
- **DPWH** – Department of Public Works and Highways (Philippines)
- **FWD** – Falling Weight Deflectometer
- **HDM-4** – Highway Development and Management
- **HSD** – High Speed Data
- **IRA** – Internal Revenue Allotment
- **KPI** – Key Performance Measures
- **LGA 2002** – Local Government Act 2002 (New Zealand)
- **LGNZ** – Local Government New Zealand
- **LGU** – Local Government Unit
- **LTCCP** – Long-Term Council Community Plan
- **LTMA** – Land Transport Management Act (New Zealand)
- **LTNZ** – Land Transport New Zealand
- **LTPBMC** – Long-Term Performance-Based Maintenance Contract
- **LVR** – Low-Volume Road
- **M** – Motorways and Expressways
- **MBC** – Maintenance by Contract
- **MBA** – Maintenance by Administration
- **MPM** – Management Performance Measures
- **MYPS** – Multi-Year Programming and Scheduling
- **NRIMP** – National Roads Improvement and Management Program (Philippines)
- **NAASRA** – National Association of Australian State Road Authorities
- **OPM** – Operational Performance Measures
- **PBSMC** – Performance-based Specified Maintenance Contract
- **PRB** – Philippine Road Board

- **PSMC** – Performance Specified Maintenance Contract
- **PMS** – Pavement Management System
- **R1** – Rural roads with $\geq 10,000$ vehicles per day
- **R2** – Rural roads with 4,000 to 9,999 vehicles per day
- **R3** – Rural roads with 1,000 to 3,999 vehicles per day
- **R4** – Rural roads with 0 to 999 vehicles per day
- **RA** – Republic Act (Philippines)
- **RAMM** – Road Asset Maintenance Management
- **RBIA** – Road and Bridge Information Application
- **RCA** – Road Controlling Authority
- **RIMSS** – Road Information and Management Support System
- **SCRIM** – Sideways Force Coefficient Routine Investigation Machine
- **TLA** – Territorial Local Authority
- **Transit** – Transit New Zealand
- **WB** – The World Bank

1 GENERAL INTRODUCTION

1.1 Introduction

The roads less travelled, traditionally known as low-volume roads (LVR), are perceived to be one of the pillars for socio-economic growth in developed countries like New Zealand and developing countries like the Philippines. These roads, carrying fewer than 500 vehicles per day, are essential as they support a nation's leading income generators like agriculture (i.e. farming, sheep and cattle raising, dairy, and wine making), forestry and tourism.

Improving road maintenance in the Philippines, based on New Zealand experience, is the goal of this research with the theme of making a move from prescriptive specifications to performance-based (end-result) specifications for unsealed low volume roads. The procurement method used for road maintenance has a great impact on the delivery of service and can generate the best value for the roading dollar.

Road authorities manage the maintenance of unsealed low volume roads based on plans and strategies that are adaptable to the locality's geographic, economic, social, cultural, environmental and climatic conditions. Assessment of desired outcomes is key to evaluating the level of service. Assessment may be in terms of method specifications – how the work is to be performed by the contractor, or the performance-based specifications – outcomes and performance required of the network (Transfund New Zealand 2001). Some New Zealand road controlling authorities (RCAs) have implemented the latter.

The 74 Territorial Local Authorities (TLA) in New Zealand are RCAs responsible for maintaining about 82,000 kms of local roads, 41 percent of these, unsealed low volume roads¹. Maintenance is outsourced by RCAs, subsidised by Land Transport New Zealand (LTNZ, formerly Transfund New Zealand). In 2003, 58% of the total

¹ [http:// www.transfund.govt.nz](http://www.transfund.govt.nz). Transfund New Zealand. *Roading Statistics*. Visited 13 July 2004.

roading maintenance was funded by LTNZ to augment limited resources of RCAs for such activities. A major thrust to this endeavour is embodied in the Local Government Act 2002 (LGA 2002) and the Land Transport Management Act 2002.

The New Zealand Local Government Act 2002 is aimed at assuring the present and future social, economic, environmental and cultural welfare of communities (Wilson and Salter 2003). For local government to achieve this objective, it has to provide sustainable roads, which are vital requisites for socio-economic development. Local Authorities are required to have a Long Term Council Community Plan (LTCCP), covering a period of 10 years. The LTCCP encompasses details concerning local authorities' policies, management plans, activities, community outcomes, decisions, budget, and finances supported by an audit report. Furthermore, local authorities are also required to identify community outcomes at least once every 6 years with the intention to evaluate desired community outcomes, prioritise identified outcomes, quantify accomplishments, and assess community resources. Since the thrust of LGA 2002 is into community involvement, there is a need to adopt a valuation scheme for maintenance management systems that can be visualised and comprehended by non-technical individuals.

Road controlling authorities are responsible for delivering a level of service acceptable to the communities in terms of management, maintenance and development of roads. Consequently, RCAs and contractors have entered into long-term performance-based contracts, from 3 to 10 years, which give contractors the opportunity to innovate and improve their maintenance management systems. Also, contractors are given the option to carry out maintenance activities where and when they are needed, and how they are undertaken (Douglas et al. 2004). The key performance indicators are that there is minimal deterioration up to an acceptable threshold level on the road network throughout the duration of the contract, high quality work is delivered on time, is within the budget and should be accepted by the community. A survey conducted on local authorities (Transfund New Zealand 2001) disclosed that the best practice for maintenance is to specify outcomes, rather than methods. However, some RCAs still practise the use of method specifications rather than performance-based specifications in the maintenance of unsealed low volume roads. The challenges now are how to manage a change from the prescriptive to end-

results methods and determining the level of service and outcomes expected by communities.

In the Philippines, local roads are managed by Local Government Units, with more than 50 percent unsealed low volume roads. The Department of Public Works and Highways (DPWH) through the Bureau of Maintenance operates and maintains national roads, 37 percent of which are unsealed and more than 30 percent low volume. Moreover, the DPWH provides farm-to-market roads for rural communities by assisting other agencies of government like the Department of Agriculture and Department of Land Reform. Farm-to-market roads are vital links from the remote barangays (villages) to urban centres. This is in support of the President's campaign to achieve economic growth and development through fast delivery and low transportation cost by providing rural areas with high quality infrastructure facilities². Considering the present economic and road network condition of the Philippines, it is imperative to import expertise from developed countries like New Zealand, which is applicable and adaptable to the Philippine setting.

The World Bank supported options for road reforms in the Philippines similar to New Zealand wherein the road fund is separate, funds all road networks, specifies criteria for economic justification of expenditures and operates under performance-based contract agreements (World Bank 2000).

1.2 Background

The Local Government Act 2002 of New Zealand requires Local Councils acting as Road Controlling Authorities to provide sustainable roads, assuring the present and future social, economic, environmental and cultural welfare of communities. RCAs are expected to carry out maintenance of roads to satisfy outcomes required by the stakeholders.

² <http://www.dpwh.gov.ph/News/2005/apr%20may%20jun.asp#239-KM%20OF%20FARM%20TO%20MARKET%20CONSTRUCTED%20WITHIN%20FIRST%20100%20DAYS%20OF%20EBDANE%20LEADERSHIP>. Department of Public Works and Highways. 239 Kilometers of Farm to Market Constructed within First 100 Days of Ebdane Leadership. Visited 5 October 2005.

New Zealand has been in the forefront in the procurement of services for the maintenance management of the road network. RCAs are treating asset improvement and asset management as a business venture, outsourcing total network maintenance to the private sector. Maintenance management of roads has evolved from setting inputs to requiring outcomes.

1.3 Conceptual Framework (Justification)

For the past 5 years, the Philippines, through the DPWH, have been introducing reforms in the operation and maintenance management of the road network, as a condition of a loan provided by the World Bank³. It supported options for road reforms in the Philippines similar to New Zealand.

This research will focus on the operation under performance-based contract agreements. With the on going reforms in the Philippines, three long-term performance-based maintenance pilot projects were implemented in 2002 under the World Bank funded National Road Improvement and Management Program (NRIMP). If these projects are successful, this type of outsourcing maintenance will be expanded to other provinces under later NRIMP phases.

New Zealand study of road controlling authorities will be a guide for the researcher to determine how to manage the change from method specifications to performance-based specifications.

1.4 Objectives of the Study

The objectives of this study were:

1. To study the effect of changes stipulated in the New Zealand Local Government Act 2002 on the maintenance of low volume roads;

³<http://web.worldbank.org/external/projects/main?pagePK=104231&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P039019>. The World Bank Group. First National Roads Improvement Project. Visited 17 October 2005.

2. To survey New Zealand road controlling authorities to see how far have they come in adopting and implementing performance-based specifications;
3. To determine the factors affecting adoption of the new system, what made it easy using performance-based specifications and what are the impedances;
4. To make recommendations on how to manage the change from prescriptive methods to end-result methods in the Philippines;
5. To compare the assessment of road maintenance in New Zealand and the Philippines in terms of techniques, equipment and personnel involved;
6. To make preliminary recommendations on what the performance-based specifications should be, the acceptable limits and how they should be quantified.

1.5 Scope and Limitations of the Study

The scope of this study is limited to evaluating the management of performance-based specifications for the maintenance of unsealed low volume roads by RCAs in compliance with guidelines stipulated in the New Zealand LGA 2002. This research will not delve into the technology used for road maintenance but will be limited to the assessment of outcomes as a basis of acceptance of work accomplished.

1.6 Methodology

1.6.1 Review of New Zealand Local Government Act 2002

A thorough review of the New Zealand Local Government Act 2002 (LGA 2002) was conducted in relation to its effects on maintenance management systems for unsealed low-volume roads. The LGA 2002 required local authorities to act as road controlling authorities in their respective areas. RCAs are the owners of the local road network, therefore, they are responsible for its operation and maintenance. Section 93 of LGA 2002 stipulates the provisions for Long Term Community Council Plans (LTCCP) for all local authorities, covering all council activities and

management of assets including the road network. As such, the LTCCPs of local authorities were studied relative to the operation and maintenance of the local road network.

1.6.2 Survey of New Zealand Road Controlling Authorities

1.6.2.1 Road Controlling Authorities

The road network in New Zealand is made up of the state highways, motorways and local roads. The latter is operated and managed by local councils acting as road controlling authorities, while the rest of the network is controlled by Transit New Zealand.

A survey questionnaire was sent to 52 of a total of 74 Road Controlling Authorities (RCAs) in New Zealand with roading asset managers or personnel in charge of the maintenance of unsealed low-volume roads as the target respondents. The RCAs were chosen on the basis of the significant length (at least 100 km) of unsealed low-volume roads being maintained.

1.6.2.2 Survey Questionnaire

A survey was conducted to identify RCAs that have adopted performance-based specifications and the extent of implementation. It was a tool to verify the systems in place and the schemes used in the maintenance management of the local road network. The questionnaire was intended to find out the accelerating and impeding factors in adopting performance-based specifications.

This research is qualitative in nature. Questions in the survey are open-ended and designed for the respondents to impart their views and insights on the systems utilised in the maintenance management of unsealed low volume roads. There are no definite answers, thus, responses vary from different RCAs.

1.6.2.3 Grouping of Road Controlling Authorities

Responses from the survey were used to assess the RCAs and divide them into RCAs that used performance-based specifications and RCAs that use method specifications. Some ambiguities in the responses were verified by reading through available resources particularly the Long Term Council Community Plans (LTCCP)⁴ of Territorial Local Authorities.

1.6.2.4 Contributing Factors

The internal and external contributing factors were established based on the survey results and attributes relative to RCAs in New Zealand. Analysis on the contributing factors was conducted to identify any patterns there might be for RCAs that have adopted performance-based specifications.

1.6.3 Review of Maintenance Management Systems in the Philippines

The present maintenance management system in the Philippines was examined by reviewing existing laws and Department Orders of the Department of Public Works and Highways (DPWH). Interviews were conducted with key personnel at the Bureau of Maintenance, the consultant for the Roadway Information and Management Support System (RIMSS), and the Deputy Project Director for RIMMS.

1.6.4 Comparison of Performance-based specifications

A comparison of performance-based specifications in New Zealand and the Philippines was conducted. The elements of a performance specification were discussed and typical performance specifications for both countries were presented in Chapter 7.

⁴ <http://www.localcouncils.govt.nz>. The Department of Internal Affairs. Local Councils. Visited 16 July 2005.



This chapter presented the general introduction to the study on the road management systems in New Zealand that can be applied in the Philippine road network. The outline of the thesis and manner by which the study was conducted were shown in detail.

The following chapter will describe the road networks of New Zealand and the Philippines. A comparison between the two countries in terms of road network statistics and road management is given to visualise the setting for which this research was initiated.

1.7 References:

- D. Michael Cleary and Partners, (2003). "Annual NRIMP-1BIIPs Subcomponent Benefits/Cost Monitoring Report with Initial Baseline Measures and Values." D. Michael Cleary and Partners, Inc., Manila.
- Douglas, R. A., Mitchell, S. A., and Pidwerbesky, B. D. (2004). "Adaptation of a Grading Management System for Unsealed Road Networks in New Zealand." Proceedings Pavements Unbound, 6th International Symposium (Unbar 6, 6-8 July 2004, Knottingham, England). AA Balkema Publishers. London.
- Philippine Road Board. (2001). "Philippine Road Board Operating Procedures Manual." Philippine Road Board. Manila.
- Transfund New Zealand. (2001). "Survey of Local Authority Maintenance Management Process." *PM00/875A*, Transfund New Zealand. Wellington.
- Wilson, V., and Salter, J. (2003). *A Guide to the Local Government Act 2002*, Brookers Ltd., Wellington.
- World Bank. (2000). "Project Appraisal Document on a Proposed Loan for the Republic of the Philippines for the First National Roads Improvement and Management Program." *19754-PH*, The World Bank. The document can be retrieved from http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2000/02/18/000094946_00020205301940/Rendered/PDF/multi_page.pdf.

2 THE ROAD NETWORKS IN NEW ZEALAND AND THE PHILIPPINES

2.1 Introduction

The Philippine and New Zealand road networks have vital roles in supporting the economic, social, cultural and environmental development of both countries. The road networks in these countries have characteristics that are on the extremes. The individual road networks are described in detail and then a comparison is made in terms of the road statistics and road management.

2.2 Philippine Road Network

The road network is the key element in the transport and communication infrastructure in the Philippines. Its role is vital in the socio-economic growth of the country by integrating rail, air, and sea transport. The road network is a basic part of transport that provides access from remote communities to urban areas supporting economic, agricultural, social, cultural, environmental needs of the community. The management of the road network represents a sizeable portion of the governments' investments and expenditures, presenting a great impact on the nation's progress.

The Philippines has an extensive road network consisting of 28,500 km (2005)⁵ of national roads⁶ and 171,900 km (2002)⁷ of local roads⁸ (Figure 2.1). In 2000, the Philippines ranked 16th in the world for the total length of the road network⁹. Only

⁵ <http://www.dpwh.gov.ph/>. Department of Public Works and Highways. Existing National Roads (kilometers) by Surface Type (as of August 2005). Visited 12 September 2005.

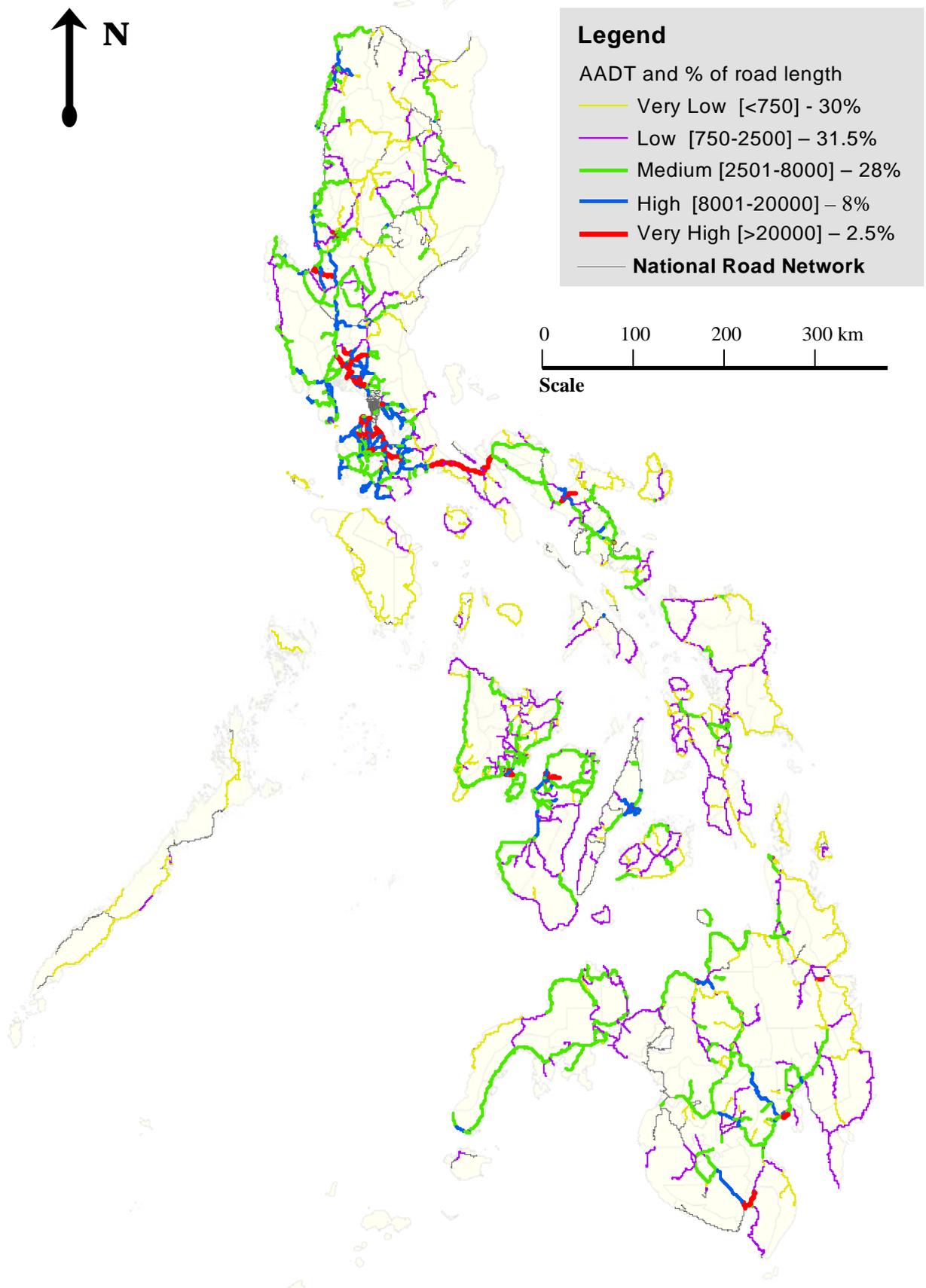
⁶ National roads are state highways; these are main arterial roads that link provinces.

⁷ Philippines. Department of Public Works and Highways. Existing Roads and Bridges By System Classification and Pavement Type by Region, Province, and Legislative District (Updated as of December 2001).

⁸ Local roads consist of provincial roads (secondary roads within provinces that interconnect municipalities), municipal and city roads (roads in urban areas and cities), and barangay or village roads (roads that link the villages to urban areas and classified as farm-to-market roads).

⁹ http://www.nationmaster.com/graph-T/tra_hig_tot&int=24. Nation Master. Visited 22 September 2005.

Figure 2.1. Philippine National Road Network



Source: Department of Public Works and Highways. Planning Service. Infrastructure Planning Research and Statistics Division.
Copy received 10 January 2006.

21% of the total road network is paved, either concrete (Figure 2.2) or asphalt, and the rest is gravel (Figure 2.3) or earth surfaced. The proportion of paved surfaces for national and local roads is 70% and 14%, respectively. Average road density in the Philippines is 0.67 km/km^2 ¹⁰, which is comparable to most Asian countries.



Figure 2.2. Paved national road.

The Department of Public Works and Highways (DPWH) is responsible for the management of national roads, the main arterial roads that link provinces. Moreover, the DPWH is responsible for the improvement of local roads under “congressional initiatives”. The national roads in the Philippines correspond to state highways managed by Transit New Zealand and the local roads in the Philippines are administered by Local Government Units (LGUs) corresponding to Road Controlling Authorities (RCAs) in New Zealand.

¹⁰ Total length of road divided by the total land area of the Philippines.

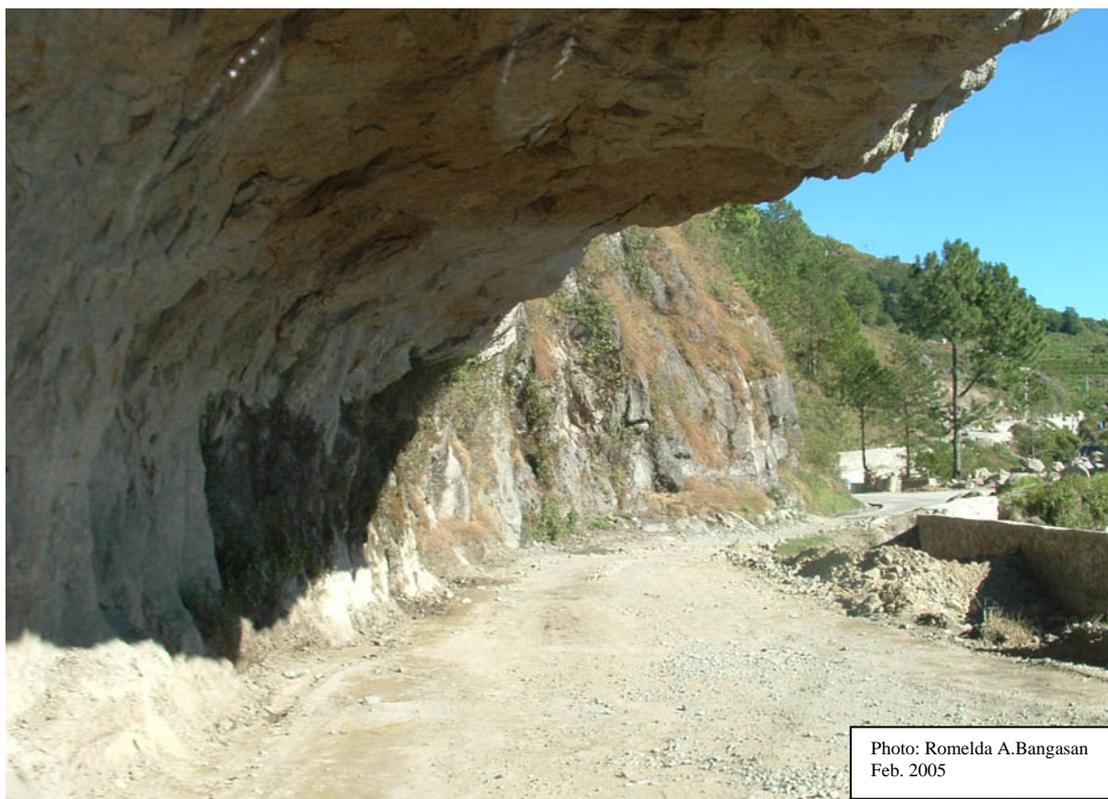


Figure 2.3. Unsealed low-volume road.

According to a study conducted by the Asian Development Bank (ADB)¹¹, the road network in the Philippines is generally adequate in extent, but many roads are in poor condition due to inadequate management that includes planning, design, construction and maintenance. The increasing traffic, heavy vehicles and bad weather conditions contribute greatly to the deterioration of these roads. An Asian Development Bank (ADB) study¹² pointed out the deficiency in the planning process of the DPWH where project selection is influenced by politics and is not based on systematic analysis of the general network needs. Furthermore, priorities are not frequently determined in terms of economics and technical appraisals, therefore, influencing funding allocation and project selection. The ADB also recognised the fact that the problem of maintaining the non-national roads (local roads), which make up more than 80% of the road network cannot be ignored. Encouraging good governance is imperative to dealing with this problem.

¹¹ Rural Road Development Policy Framework, a research paper conducted by the Asian Development Bank. 2001.

¹²<http://www.asiandevbank.org/Documents/PERs/IE50.pdf#search='Philippine%20Transport%20Strategy%20Study'>. Asian Development Bank. Impact Evaluation Study of Bank Operations in the Road Sector in the Philippines Dec. 1997. Visited 17 October 2005.

In order to meet the demands and expectations of the community, the primary beneficiaries of an effective and efficient road network, a cost-effective management of the asset is crucial. Studies conducted by the Asian Development Bank and the World Bank brought about significant reforms in the management of this vital asset in the Philippines. The policy framework of the DPWH is founded on its Mission and Vision¹³, which brought about reforms, with the needs of the customers and other stakeholders as its main concern.

DPWH Mission:

To provide and manage quality infrastructure facilities and services responsive to the needs of the Filipino people in the pursuit of national development objectives.

DPWH Vision:

DPWH is a model agency in government, improving the life of every Filipino through quality infrastructure.

2.2.1 Reforms

In 1997, the Road Information and Management Support System (RIMSS) Project was established under the World Bank financed Highway Management Project. The objective of the RIMSS is to introduce reforms in the DPWH relating to network planning and programming, design review and contract management, maintenance, procurement, financial management, human resource and information management. The RIMSS project, together with Better Roads Philippines (BRP) Study were the basis for the World Bank First National Roads Improvement and Management Project (NRIMP) in 2000¹⁴. The NRIMP was developed to guarantee the preservation of the national road system (NRS) through enhancement in design, initiation and operation. The specific aims of NRIMP are: “a) to involve road users in managing the roads as well as administering the funds they contribute, and b) manage the roads in a commercial fashion, rather than a social service”. To achieve

¹³<http://www.dpwh.gov.ph/>. Department of Public Works and Highways. Mission and Vision. Visited 12 September 2005.

¹⁴http://www.wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2000/02/18/000094946_00020205301940/Rendered/PDF/multi_page.pdf. The World Bank Group. National Road Improvement and Management Project-Project Appraisal Document. Visited 17 October 2005.

these objectives, NRIMP is concentrating on two main components: 1. civil works, which include: a) road upgrading, b) preventive maintenance, and c) long term performance based maintenance aiming at multi-year contract performance that included routine and periodic maintenance activities, and 2. institutional strengthening, which incorporates creation of road maintenance fund, institutional reforms, designing an independent organisation for policy making, financial and human resource management, and business improvement.

This research is focused on the NRIMP Project's Civil Works component, Performance-Based Maintenance sub-component, which is discussed in detail in the NRIMP Project Appraisal Document¹⁵:

Project Component 3 - US\$ 9.96 million

A.3 Long-Term, Performance-Based Maintenance (LTPBM). This component aims to test the performance of multi-year routine, periodic and preventive maintenance contracts. Payments under the LTPBM component will be based on outcomes; that is, whatever task the contractor is expected to perform must meet the established standard (minimum service level), and not simply have completed a certain quantity of physical work.

Under NRIMP- 1, two pilot contracts for 231 km of national roads in Laguna and Quezon provinces will be issued for an estimated P375 million, including contingencies and consultant services, that will help contractors prepare bids and BOM supervise the contracts.

The component will be implemented in two contracts, each over three years beginning right after project effectiveness. The first contract involves the 97.1 km Famy Infanta Road and Pagsanjan -Luisiana-Lucban-Tayabas Road and will cost an estimated P137 million. The second involves Daan-Maharlika Highway, Tiaong-Lucena Junction and the Pagbilao to Camarines Norte Boundary sections of approximately 134.3 km, and will cost an estimated P166 million. Each contract includes three major maintenance components—for preventive work, catch-up routine work and performance (routine and periodic work). Preventive maintenance is designed to improve the roads' structural condition. Catch-up routine maintenance is designed to reduce the present maintenance backlog, particularly with respect to shoulders and drainage. Some minor improvements may be included such as additional drainage structures, slope protection, guard rails, road signs, markings and reconstruction of short sections. After preventive and catch-up routine maintenance are completed, performance maintenance will begin. The

¹⁵http://www.wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2000/02/18/000094946_00020205301940/Rendered/PDF/multi_page.pdf. The World Bank Group. National Road Improvement and Management Project-Project Appraisal Document. Visited 17 October 2005.

preventive and catch-up routine maintenance contracts will be executed and paid for in the usual manner (based on the quantity of work completed). The performance maintenance, however, will be executed according to minimum standards set in the contract. If contractors fail to maintain them, the monthly lump sum payment will be reduced, according to the penalties for non-compliance delineated in the contract.

NRIMP-2 and-3. If successful, this initiative will be expanded to other provinces under future NRIMP phases. Because NRIMP-I is a limited pilot in one sub-region of the country, further pilots will probably be needed to incorporate a broader range of physical, social and economic conditions: NRIMP-II will be designed to address them. Under NRIMP-III, the LTPBM sub-component may be expanded throughout the country on a small scale to serve as a training ground for this type of maintenance program. Growth from then on will reflect the readiness of DPWH and market conditions.

Implementation arrangements. The BOM, which will be responsible for managing the project, will supervise the LTPBM contract. The regional office will coordinate with the districts and provide specialists (for controlling quality and surveying quantities). The BOM-assigned engineer, along with the district offices, will be responsible for supervising the contracts daily, which will cover work in progress and monitoring compliance with performance criteria. DPWH will be assisted with an international consultant who will work with the LTPBM team. The PIP provides further details on implementation arrangements.

Performance-based maintenance contracts were adopted on a trial basis by way of two pilot projects in DPWH Region IV-A¹⁶. At the project preparation stage, the consultant deemed it necessary to split one pilot project into two projects due to its large scope. Bidding for these projects was conducted in August 2001 and were awarded winning contractors a year after. Prior to the bidding process, BCEOM Société Française D'Ingenierie was awarded a contract for consultancy services for long-term performance-based maintenance.

It is worth mentioning that “the World Bank supported the evolution to a model similar to New Zealand in which the Road Fund is: (i) separate, (ii) funds all road networks, (iii) specifies criteria for economic justification of expenditures, and (iv) operates under performance-based contract agreements with the beneficiary

¹⁶<http://web.worldbank.org/external/projects/main?menuPK=228443&theSitePK=40941&pagePK=233764&piPK=233766&Projectid=P039019>. The World Bank Group. Visited 17 October 2005.

implementing agencies on one hand, and with Government on the other hand for the authorization of the total revenues to be raised and budget to be spent”.¹⁷

To address the preceding recommendations from financial sponsors, the Government of the Philippines approved Republic Act (RA) 8794, a law on Motor Vehicle User's Charge and It's Implementing Rules and Regulations, whereby the Philippine Road Board and the DPWH Road Program Office were created in November 2000. OPUS International Consultants provided technical assistance under the NRIMP Project's Policy and Institutional Reform Component, Support to Commercialisation sub-component. The Road Board has the following functions (Philippine Road Board 2001):

1. Operation of special funds
2. Management of special funds
3. Approval of work programs
4. Approval of special budgets
5. Review of work programs
6. Complementary work programs under other funding
7. Procedures for monitoring performance and managing programs
8. Approval of contracting methods
9. Utilisation of special funds
10. Public awareness and reports
11. Supervisory authority

Section 7 of Republic Act 8794 classified Special Funds under the following:

1. Special Road Support Fund – 80% to be used for the maintenance and improvement of drainage of national roads;
2. Special Road Safety Fund – 7.5% to be used for the installation of traffic lights and safety devices;
3. Special Local Road Fund – 5% to be used for the maintenance of local roads, traffic management and road safety devices;
4. Special Vehicle Pollution Control Fund – 7.5% of the revenue.

¹⁷http://www.wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2000/02/18/000094946_00020205301940/Rendered/PDF/multi_page.pdf. The World Bank Group. National Road Improvement and Management Project-Project Appraisal Document. Annex 12. Visited 17 October 2005.

The Philippine road network had been described in detail with the important aspects in place. The following section will illustrate the features of the New Zealand road network.

2.3 New Zealand Road Network

The road network is the backbone for the transport system in New Zealand, linking water, rail and air transport. Its role is vital in the economic, social, and cultural development of the country. The management of the road network is embodied in the Local Government Act 2002, the Land Transport Management Act 2002 and the New Zealand Land Transport Strategy, aiming to achieve an integrated, safe, responsive, and sustainable transport system. The governments' objectives for transport are: 1) assisting economic development, 2) assisting safety and personal security, 3) improving access and mobility, 4) protecting and promoting public health, and 5) ensuring environmental sustainability¹⁸.

The New Zealand road network is ranked number 30 in the world with a total length of more than 92,000 km¹⁹. Almost 60 percent of the extensive road network is sealed²⁰ with either chip seal surface, asphalt concrete, porous asphalt or slurry seal. State highways (Figure 2.4), which are planned, developed and maintained by Transit New Zealand, have a length of 10,700 km and carry 46 percent of all New Zealand traffic²¹. About 0.4% of the total road network is motorway, carrying 9% of the traffic²². The local road network, with a length of 81,700 km, carries 55 percent of the traffic. The 74 Territorial Local Authorities acting as the road controlling authorities in their jurisdictions oversee the local roading asset.

¹⁸ <http://www.transport.govt.nz>. Ministry of Transport. New Zealand Transport Strategy. December 2002. Chapter 1. Visited 14 July 2004.

¹⁹ http://www.nationmaster.com/graph-T/tra_hig_tot&int=24. Nation Master. Visited 22 September 2005.

²⁰ <http://www.transfund.govt.nz>. Transfund New Zealand. Roothing Statistics. Visited 9 July 2004.

²¹ <http://www.transport.govt.nz>. Ministry of Transport. New Zealand Transport Strategy December 2002. Visited 14 July 2004.

²² <http://www.transport.govt.nz>. New Zealand Transport Strategy December 2002. Visited 14 July 2004.

Figure 2.4. New Zealand's State Highway Network²³



²³ <http://www.stats.govt.nz>. Statistics New Zealand, Census of Population and Dwellings 2001. Visited 5 October 2005.

New Zealand is one of the countries in the world with the best-managed road network (Figures 2.5 and 2.6). This is a reflection of the support given by the national government through its programs and cooperation of the RCAs through the LTCCP and Annual District Plans. Professional organisations in New Zealand are



Figure 2.5. Well maintained New Zealand state highway.

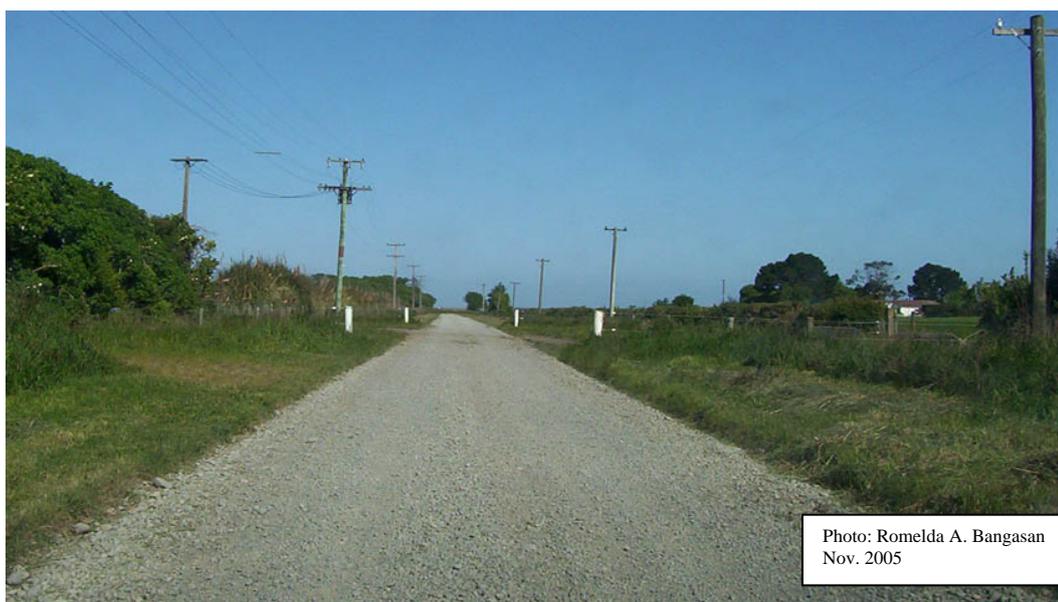


Figure 2.6. Well maintained New Zealand unsealed low-volume road.

serious about improving the transport sector. Road asset management is one of the primary concerns that involve a systematic approach to maintaining, upgrading and operating the road assets cost effectively by combining engineering principles with sound business practices and economics²⁴.

2.4 Comparison

2.4.1 Road Authorities

The Department of Public Works and Highways manages national roads and bridges in the Philippines. The fund for its operation and maintenance is allocated from the General Appropriations Act (GAA) from the government and from foreign grants and loans. On the other hand, New Zealand's state highways are managed by Transit New Zealand and resources are allocated by Land Transport New Zealand (formerly Transfund New Zealand).

Local roads are managed by the local government in both countries based on their territorial jurisdiction. In the Philippines, the provincial, municipal and city governments operate their local roads while Territorial Local Authorities (TLA) in New Zealand act as the road controlling authorities as mandated in the Local Government Act 2002. Funding for these roads are sourced by the local governments and subsidised by the national government and LTNZ, for the Philippines and New Zealand respectively.

2.4.2 Road Statistics

The Philippines and New Zealand are opposites in many aspects of the road network including condition, usage, traffic type, traffic volume, and density, as shown in Table 2.1 The Philippines is about 30,000 km² larger than New Zealand in terms of

²⁴ <http://www.zietlow.com/docs/r296-059.pdf>. Dr Gunter Zietlow. Norwell, G. 1997. Managing the Road Asset in Australia and New Zealand. Visited 24 February 2006.

land area but the road length in the Philippines is twice that of New Zealand. More than 58,000 km of roads in New Zealand is paved, accounting for 63 percent of the total road network, while a little more than 40,000 km is paved in the Philippines representing only 21% of the total road network. In 2003, the total maintenance expenditures were NZ\$356M and NZ\$125M for New Zealand and the Philippines,

Table 2.1. Road statistics.

	New Zealand	Philippines	<u>Philippines</u> New Zealand
State Highways			
- Length (km)	10,700	28,500	2.70
- % Sealed	100%	70%	0.70
Local Roads			
- Length (km)	81,700	171,900	2.10
- % Sealed	59%	14%	0.24
Total Roads			
- Length (km)	92,400	200,400	2.20
- Unsealed Length (km)	34,300	159,600	4.70
- % Sealed	63%	21%	0.33
Vehicle Abundance (vehicles/per km ²)	25	8	0.32
Motor Vehicles (vehicles/1,000 people)	560	31	0.055
Highways-total per capita (km/1,000 people)	23	2.5	0.11
Population Density (people/ km ²)	14	266	19
Land Area (km ²)	268,000	298,000	1.10
Road Density (km/ km ²)	0.35	0.70	2.00
Maintenance Expenditure (2003)	NZ\$356M	NZ\$125M	0.35
Maintenance Expenditure per kilometre (\$/km)	NZ\$3,900	NZ\$620	0.16

respectively. Philippine roads are twice as dense as New Zealand (0.67 vs. 0.34 km/km²) yet vehicle ownership in New Zealand is 18 times more than the Philippines (560 vs. 31 motor vehicles/1,000 people)²⁵. Vehicle abundance in the Philippines is about a third that of New Zealand (7.42 vs. 25.26 vehicles/km²). Although the

²⁵ http://www.nationmaster.com/graph-T/tra_mot_veh&int=90. Nation Master. Visited 22 September 2005.

Philippines has more roads, there are fewer vehicles using the roads, compared to New Zealand, as shown by the figures. The low population density in New Zealand (13.6 people/ km²) contributes much to the high highways total per capita of 22.81 km/1,000 people. New Zealand ranked 11th in the world for the highway per capita, while the Philippines is ranked 125th (2.29 km/1,000 people)²⁶ due to the high population.

.....

The road networks in New Zealand and the Philippines were described in detail. A comparison of the road networks and road authorities for both countries was established to set the focal point of this research.

Chapter 3 is about the New Zealand Local Government Act 2002 which prescribes the requirements for the provision, operation, and management of the local road network.

2.5 Reference:

Philippine Road Board. (2001). "Philippine Road Board Operating Procedures Manual." Philippine Road Board. Manila.

²⁶ http://www.nationmaster.com/graph-T/tra_tot_cap&int=164. Nationa Master. Visited 22 September 2005.

3 NEW ZEALAND LOCAL GOVERNMENT ACT 2002

3.1 Introduction

The Local Government Act 2002 is aimed at assuring the present and future social, economic, environmental and cultural welfare of communities (Wilson and Salter 2003). For local government to achieve this objective, it has to provide sustainable roads, which are vital requisites for socio-economic development. Local Authorities are required to have a Long Term Council Community Plan (LTCCP), covering a period of 10 years. The LTCCP encompasses details concerning Local Authorities' policies, management plans, activities, community outcomes, decisions, budget, and finances supported by an audit report. Furthermore, Local Authorities are also required to identify community outcomes at least once every 6 years with the intention to evaluate desired community outcomes, prioritise identified outcomes, quantify accomplishments, and assess community resources.

3.2 The Local Government Act 2002

The 1974 Local Government Act was prescriptive with details on the requirements for roads, land drainage, and waste management (The Department of Internal Affairs 1974). It set out what local authorities must do, what they could do, and how they were to do things. The Act empowered local councils to control, maintain and operate all roads excluding state highways. The provisions relating to roads have been retained in the Local Government Act 2002 (LGA 2002). At the turn of the century, trends have been on annual planning with a formal consultation process for input to proposed activities, service levels, and funding. At this stage community participation is being integrated into the system, thus there is a need for change in the structure.

The Local Government Act 2002, which received Royal acceptance on December 2001, is a major reform. The Act confers generalized power on all local authorities to have full capacity to do anything for the purpose of their role, on behalf of

communities. In this context, the purpose of local government is to “enable democratic local decision-making and action by, and on behalf of, communities, and promote the social, economic, environmental, and cultural well-being of communities, in the present and for the future” (Local Government New Zealand 2003).

The fundamental nature of this change is manifested in the detailed decision-making and accountability provisions in Part 6 (Wilson and Salter 2003), emphasizing sustainable outcomes. The 1974 and 2002 Acts empower local councils to build, upgrade and maintain local roads, as they see fit depending on Government requirements and consistent with the community’s desire for high quality infrastructure services. It explicitly defines the obligations of local authorities on consultations, defining the nature and use of consultative procedures and identifying and reporting community outcomes, all integrated into a 10-year planning document, the Long Term Council Community Plan (LTCCP). Local authorities are tasked with identifying the outcomes that their communities value through consultation. The local authority duty comes with promoting and delivering services, how it will do so, at what costs, and where funding will be sourced.

Community outcomes in general terms are the expectations in the long-term, encompassing the promotion of social, economic, environmental, and cultural well-being of the general public. These are priorities identified by the community, through consultation ensuring a well-designed future appropriate to the local setting. Major considerations for identifying community outcomes are attainability and applicability. The community outcomes are essential for the district council to determine the initiatives and services that should be provided to the community to meet their needs. Services delivered, in all aspects, have specific community outcomes at defined levels of service. The Act empowers councils to be more accountable to their communities by ensuring community outcomes are prioritised in a way that reflects the overall preferences of the community.

The LGA 2002 was prescriptive in the specifying outcomes expected by the community in terms of the service and performance of the road network. Performance targets that address the actual levels of service were observed including

the implementation process towards the achievement of the outcomes. Most district councils have included specific outcomes or levels of service in their LTCCPs as far as maintenance management of the roading asset is concerned. These form part of the activities and outputs required to achieve high-level community outcomes.

Activity management plans form part of the LTCCP with community consultation as the basis for inclusion. Local government must constantly balance the multitude of roles that they play. These roles include community advocate, infrastructure service provider, regulator, and promoter of economic development. Local governments are required to remain conscious of the need to clearly separate these various roles and prevent conflicts of interest from arising. The local government's need for a comprehensive asset management program, with community outcomes as its primary concern, emanates from its function as an infrastructure service provider. In order to address the requirements of the Act, local authorities must be armed with asset management tools for it to be efficient and effective. These tools include a database capable of storing and reporting the asset extent and performance measures, coupled with an analysis tool for optimisation and decision-making. Forward works programming (10 years) is required as an input for the LTCCP and Annual Plans (Mitchell and Salter 2003). Local governments are constantly improving their asset management techniques and systems with greater focus on customer service, local government reforms, technical and financial policies, and national legislation.

Section 14, Subpart 2 of Part 2 of the Local Government Act 2002 (Wilson and Salter 2003) describes the principles relating to local authorities in performing their role. It authorises a local authority to “conduct business in an open, transparent and democratically accountable manner and give effect to its identified priorities and desired outcomes in an efficient and effective manner”. In doing so, local authorities should carry out transactions according to reliable business practices. It should take into account the opinions and interest of its current and future communities, including opportunities for Maori.

.....

The Local Government Act, enacted in 2002, was aimed at assuring the present and future welfare of communities. The LGA 1974 prescribed the requirements for the operation and management of the road network, and these were retained in the LGA 2002. In the new Act, local councils are required to have a 10-year LTCCP wherein the desired community outcomes and expected levels of service of the road network are identified.

The LGA 2002 has changed the regulatory regime for road management providing new requirements to ensure levels of service and desired community outcomes. Because of these changes, performance-based specified maintenance contracts work better as opposed to method-based specifications.

The next chapter will deal with the maintenance management systems used in New Zealand and the Philippines. The evolution of performance-based maintenance contracts will be discussed in detail and will be compared with the traditional method-based specified maintenance contracts.

3.3 References:

Local Government New Zealand. (2003). *The Local Government Act 2002: An Overview*, Wellington.

Mitchell, P., and Salter, J. (2003). *Seminar on Local Government Act 2002*, New Zealand Law Society. Wellington.

The Department of Internal Affairs. (1974). *The Local Government Act 1974, A Guide to Its Operation*, Wellington.

Wilson, V., and Salter, J. (2003). *A Guide to the Local Government Act 2002*, Brookers Ltd., Wellington.

4 MAINTENANCE MANAGEMENT SYSTEMS

4.1 Introduction

In the 1990's, road controlling agencies throughout the world were innovating to cope with pressures of increasing traffic on the road network and limited funding, for the sustainability of the network. In response to this challenge, New Zealand has been in the forefront in evolving from prescribing method-based specifications to performance-based specifications in the road network maintenance management.

This chapter will differentiate method-based maintenance contracts from performance-based maintenance contracts, giving the advantages and disadvantages of each. A discussion of the evolution of performance-based maintenance contracts and New Zealand and the Philippines is presented.

4.2 Method-Based Specified vs. Performance-Based Specified Maintenance Contracts

4.2.1 Method-Based Specified Maintenance Contracts

A method-based maintenance contract is a traditional procurement model wherein the road controlling authority, referred to as the client, is responsible for managing the network and the maintenance of physical works are outsourced. This requires the client to have sound asset management skills. In this model, the client demands the contractor what work is to be done, when to do it, and the extent of the work. The contractor is paid on the basis of a defined output or quantity accomplished, and the schedule of rates. Risk transfer is very low in this model as the client retains most of the risk involved in the contract. This type of procurement model does not encourage the contractor to innovate, as the client's engineer is required full-time supervision and is responsible for work identification and programming.

4.2.2 Performance-Based Specified Maintenance Contracts

Performance specified maintenance contracts (PSMC) are called performance-based specified maintenance contracts (PBSMC) in some road authorities. In this research, it is referred to as PBSMC. Performance-based contracts define what goods and services are required, not how to produce them (Robertson 2003). The expected outcomes are explicitly defined in the contract and paid on a fixed lump sum price.

In this procurement model, the contractor is responsible for all aspects of road asset management, professional services and physical works. As the contractor is in full control of the network, he must know and understand the current condition and future needs of the asset, thus, the contractor will be able to introduce innovations and be proactive in his maintenance management programme. The goal is to prescribe performance specifications that allow contractors to demonstrate their individual expertise, creativity, and resources without controlling them with predetermined methods or processes. Since there is a substantial risk transfer from the client to the contractor, the latter must have strong asset management skills to be able to mitigate the risks involved. The model involves a low level of supervision, requiring only verification of outcomes on the part of the client. The contractor is expected to have more initiative in preparing forward works and programmes, requiring high- level skills and expertise.

4.2.3 Advantages of Performance Specified Maintenance Contracts

Road authorities are continuously improving in obtaining levels of service that would benefit the stakeholders and road users. Hardy (Hardy 2001) described benefits as “a) the same level of service at a reduced cost or, b) a better level of service at the same cost or, c) a better level of service at a reduced cost”. Road agencies in New Zealand and in other countries that are outsourcing maintenance through performance-based specifications, have attested to cost savings from 15 to 38 percent (Porter 2005, Zietlow 2004, Hardy 2001). The cost savings incurred by the client give better value for money. Performance-based specifications increase the probability of achieving best results in terms of products and services at less cost. The model allows the

contractor to utilise best practices that give opportunity to determine work processes and improve levels of service. Cost savings, for the road authority, are derived from the need for less supervision and control since the contractor is responsible for the quality control (Zietlow 2004).

Performance specifications are focused not only on the pavement requirements but also on the customers' needs. Since the outcomes are aligned with road user requirements, road users are more proactive in supporting maintenance programmes. With this development, the road agency can have an alliance with customers to evaluate the efficiency and effectiveness of the contractor, and the quality of service delivered.

The level of risk transferred to the contractor increases as the procurement model moves from method specified to performance specified maintenance contracts, thus, reducing the risks of the road agency. Figure 4.1 shows the distribution of risk to road agencies and contractors with the different types of procurement models (Zietlow 2004). At the tendering stage, the contractor is well informed of the possible

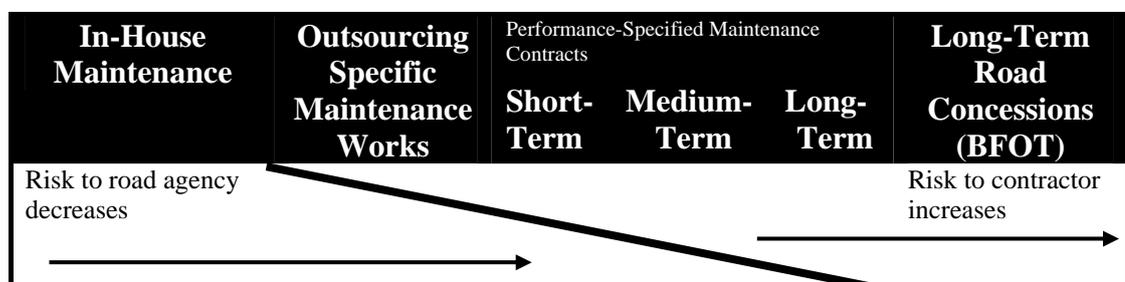


Figure 4.1. Risk distribution (after Zietlow, 2004)

risks involved in project implementation. The contractor is expected to have strong risk assessment and risk management skills and to come up with a comprehensive risk management programme to soften the impact of these risks.

Performance-specified maintenance contracts involve the contractor's innovation and high technical expertise to come up with maintenance programmes that require intervention at the optimum time, with the right activity at the right timing. This will result in the primary benefit of better value for money, cost-savings in terms of

manpower, materials, and equipment, as there is price certainty for a defined level of service.

Improving road condition with the confirmation of savings is one of the important benefits of PBSMC contracts, maintaining a certain level of service over a period of time. The extended term of the contract permits the contractor to experience a sense of ownership of the asset. This increases his initiative to improve the asset by employing and training staff armed with appropriate technical skills.

The move to adopting performance-based specified maintenance contracts permits the reduction of the road agency's staff, as it will be concentrating more on policy formulation and validation of works. The road agency need not maintain road equipment used for in-house maintenance. This will result in further reductions in agency costs.

4.3 Performance-Based Maintenance Contracts in New Zealand

4.3.1 Evolution of Performance-Based Maintenance Contracts

Outsourced road management and maintenance has been evolving from specifying required inputs to desired outcomes. Porter (2005) described the evolution of highway maintenance contracts, through a value chain in Figure 4.2, which also illustrates the development of maintenance specifications. New Zealand is in the forefront of this new development, followed by most developed countries. Over time, road authorities have expanded contracts from maintenance activities to all attributes of road network management (Porter 2005).

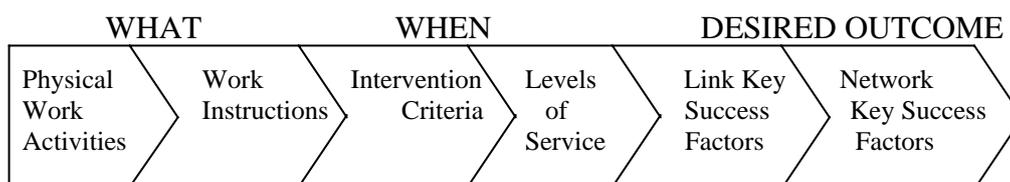


Figure 4.2. Value Chain (after Porter, 2005)

About one-third of state highway maintenance in New Zealand is outsourced through PBSMC (Transit New Zealand December 2000) wherein both network management and physical works are contracted for a lump sum price. These long-term contracts, usually 10 years in duration, define outcomes in terms of the levels of service and performance measures. The first performance-based contract in New Zealand was let in 1998 for the maintenance of 406 km of state highways (Zietlow 2004).

Maintenance management of roads has evolved from setting inputs to requiring outcomes, as most road controlling authorities in New Zealand have adopted performance-based specifications. A survey of RCAs was conducted and the results will be discussed further in the next chapter.

4.4 Performance-Based Maintenance Contracts in the Philippines

4.4.1 Evolution of Performance-Based Maintenance Contracts

The maintenance management of roads in the Philippines is method-based specifying what work is to be done and how it is done. In the value chain, maintenance management is evolving and moving from left to right. The maintenance by contract projects in the Philippines provided schedules which also specify when maintenance work is to be done. The World Bank funded National Road Improvement and Management Program (NRIMP) has introduced a new procurement model, long-term performance-based maintenance contracts, by way of pilot projects.

Three pilot projects were bid in August 2001, under the civil works component of the World Bank NRIMP:

1. LTPBMC 1 – Performance-based maintenance, preventive maintenance and maintenance backlog reduction component of Famy-Infanta, Pagsanjan-Luisiana-Tayabas-Junction Lucena Road (109 km);
2. LTPBMC 2a – Performance-based maintenance, preventive maintenance and maintenance backlog reduction component of Tiaong-Junction Lucena Road (33 km); and

3. LTPBMC 2b – Performance-based maintenance, preventive maintenance and maintenance backlog reduction component of Pagbilao-Camarines Norte Boundary Road (112 km)

The pilot projects commenced in 2002, with a contract time of 3 years. Under the same loan package from the World Bank, a separate contract for the Consultancy Services for Long Term Performance Based Maintenance was tendered in September 2000.

The road and bridge performance-based maintenance, which included regular routine and periodic maintenance activities, was one of the three components of the pilot projects. The table defining the performance requirements, the response times and penalties for non-compliance, will be examined in Chapter 7.

The construction supervision teams for the pilot projects had undergone training prior to the commencement of the contracts and during the construction period (BCEOM Societe Francaise D'Ingenierie 2005). The administrative, financial, and reporting procedures were established and standardised for all contracts. Much emphasis was given on the performance-based maintenance component of the contract as it was new to the supervising engineers. The assessment of the contractors' non-compliance to performance requirements was important to determine the monthly payment to the contractors.

In its completion report, BCEOM Societe Francaise D'Ingenierie (2005) recommended that more pilot projects in performance-based maintenance, with longer network lengths and extended terms, be considered for future funding.

.....

Two types of maintenance management systems, method-based specified and performance-based specified contracts were described in this chapter. Transit New

Zealand has been moving from requiring inputs to outcomes for the maintenance of the state highway network. Many road authorities in New Zealand have adopted performance-based specifications. The Philippines had implemented three performance-based pilot projects and the consultant has recommended the adoption of PBSMC for future road maintenance.

The results of the survey conducted on local road authorities will be discussed in the following chapter. The next chapter will also investigate the facilitating factors in the adoption of performance-based specified contracts.

4.5 References:

- BCEOM Societe Francaise D'Ingenierie. (2005). "Completion Report for Consulting Services for the implementation of of the Long-term Performance-Based Maintenance Project." BCEOM Societe Francaise D'Ingenierie. Manila.
- Hardy, P. "Austroads Review of Performance Contracts: The Potential Benefits of Performance Contracts." *Contracting the Future NZIHT Symposium*, 28.
- Porter, T. "Procurement Models for Road Maintenance." *Annual Conference of the Transportation Association of Canada*, Calgary, Alberta, Canada, 14.
- Robertson, D. G. (2003). "How to Develop Performance-Based Specifications." *Government Fleet*(September/October 2003), 12 - 13.
- Transit New Zealand. (December 2000). "Long Term Procurement Strategy." Transit New Zealand. Wellington.
- Zietlow, G. (2004). "Implementing Performance-Based Road Management and Maintenance Contracts in Developing Countries-An Instrument of German Technical Cooperation." The document can be retrieved from <http://www.zietlow.com>.

5 SURVEY OF NEW ZEALAND ROAD CONTROLLING AUTHORITIES

5.1 Introduction

A survey of New Zealand road controlling authorities (RCAs) was conducted from September 2004 to May 2005, to verify the systems in place and the procedures used in the management of the maintenance of local road networks. The survey was designed to obtain pertinent data and information regarding the extent of implementation of performance-based specifications among RCAs in New Zealand and was used as a tool to establish the profile of RCAs adopting performance-based specifications.

A structured questionnaire (Appendix 1) was sent to 52 of the total of 74 RCAs in New Zealand. The first part of the survey comprised questions related to the RCAs' organisations, which included functions and duties of personnel directly involved in the management of the maintenance of local road networks. The second part consisted of questions pertaining to specifications used, as well as the development and frequency of the revision of maintenance specifications. The third and fourth parts of the survey included questions relative to the typical maintenance activities performed on the road network and the evaluation of contractors' work, respectively.

Road asset managers or personnel in charge of the maintenance of unsealed low-volume roads were the target respondents of this survey. The RCAs were chosen on the basis of having a significant length (at least 100 km) of unsealed low-volume roads to maintain. The survey had a response of 80%. Forty responses were returned out of the 52 surveys sent. The 40 responses were used to sort the RCAs into (1) those that had adopted performance-based specifications, identified as the PBS group, and (2) those that still employed method specifications in the maintenance of unsealed low-volume roads (Table 5.1), identified as the MBS group. One RCA returned the questionnaire unanswered, noting that the questions were too broad while another RCA sent a letter expressing regret that they did not have available time or resources to complete the survey due to staffing shortages.

The research was qualitative in nature. Questions in the survey were open-ended and designed for the respondents to indicate their views and insights on maintenance management systems for unsealed low-volume roads. Some ambiguities in the responses were resolved by reading through available electronic resources²⁷, particularly the Long Term Council Community Plans (LTCCP) of the Territorial Local Authorities (TLAs).

RCAs were classified based on the responses in the survey questionnaire, stressing responses in Question 11 (Appendix 1) wherein typical maintenance activities performed on unsealed roads were listed. RCAs identified what triggered or initiated these maintenance activities and the frequency at which these activities were performed. On one hand, maintenance activities executed on a cyclic basis and with definite schedules are most likely to be carried out by RCAs employing method-based specifications. On the other hand, maintenance activities that are dependent on road conditions and service expected of the network are performed by RCAs using performance-based specifications. Some RCAs indicated in the questionnaire the type of maintenance delivery used, thus facilitating their classification. At least 8 RCAs returned the completed questionnaire with sample performance-based specifications used in their maintenance contracts.

Table 5.1 shows a significant number of RCAs in both the North Island and South Island were using performance-based specifications for the maintenance of the local

Table 5.1. RCA grouping.

	Number of RCAs	Percentage of respondent RCAs	Maintenance Delivery	Number of RCAs	Percentage of RCAs per Island
North Island	25	63	Method-Specified (MBS)	4	16
			Performance-Specified (PBS)	21	84
South Island	15	37	Method-Specified (MBS)	3	20
			Performance-Specified (PBS)	12	80

²⁷ <http://www.localcouncils.govt.nz>. The Department of Internal Affairs. Local Councils. LTCCP. Visited 15 June 2005.

road network. As mentioned in Chapter 4, about one-third of the state highways in New Zealand employed performance-based specifications. This is an indication that road authorities in New Zealand were moving from method-specified contracts toward performance-based contracts.

5.2 Contributing Factors in the Adoption of Performance-Based Specifications

The items presented in Table 5.2 could be potential contributing factors for the adoption of performance-based specifications or could possibly reveal impedances to adopting performance-based specifications. Contributing factors were derived from an analysis of the responses to the survey questionnaire and data from Statistics New Zealand, including road length, population, land area, roading expenditure and revenue.

In context, these contributing factors also may be classified as internal and external, based on how they are controlled. Internal factors are those that are directly controlled by the organisation while external factors are those that cannot be controlled by the organisation (Robinson *et al.* 1998). Factors 1 to 6 are the internal contributing factors. Those remaining in the list are classified as external contributing factors.

It was desirable to divide RCAs into PBS accepting and PBS rejecting groups on some objective numerical basis for each external factor (7-16). The division was made using the measures of central tendency in statistics, which are the mean, the true median, and the value midway between the minimum and maximum observed values. The three options were considered because there had to be a consistent, statistically driven and impartial solution to distinguish one group from the other. By using the three simple statistical characteristics, a consistent and valid basis for comparison for each of the different categories was established.

The difference of percentage between the PBS RCAs and MBS RCAs were determined in each analysis. The researcher cannot give arbitrary boundaries for each

factor because the differences will depend on the values selected as boundaries. An arbitrary boundary cannot be justified because of the different criterion for each of the factors and dissimilar units of measurement. An objective basis was sought to discriminate the factors.

Table 5.2. Contributing Factors

Factor No.	Contributing Factors	Description
1	Asset Managers	employ asset managers
2	Consultant	outsource consultancy services
3	RAMM	utilise RAMM as a management tool
4	Customer Survey	conduct customer surveys
5	Specifications Used	TNZ 'C' Specifications
		Modified TNZ'C' Specifications
		RCA's own maintenance specifications
6	Evaluation of Work Accomplished	compliance to specifications
		audits/inspections
		marking/scoring system
		ratepayer's feedback
		6 monthly performance reviews
7	Annual Maintenance Expenditure/road km	< \$xx,xxx
8	Rates/road km	< \$x,xxx
9	Revenue/road km	< \$xx,xxx
10	% Rural Road	> xx%
11	% Unsealed Rural Road	> xx%
12	Total % Unsealed Road	> xx%
13	Road Length per Engineer (km/engineer)	> xxx km/engineer
14	Road Density (km/km ²)	< xx (km/km ²)
15	Population Density (persons/ km ²)	< xx (persons/ km ²)
16	Persons/road km	< xx (persons/ road km)

In the end, a compelling argument could not be assembled, but all possibilities were explored and the researcher believed that comparing the results of the three options was the best approach to deal with the problem. The argument is weak as it is sensitive to what exactly is the boundary. It may possibly be the mean, the median, or the value midway between the minimum and maximum, but these options showed fairly consistent results.

One RCA was excluded in the analysis of external contributing factors because the results were biased. The situation and conditions of this RCA are different from the rest of the group that makes the results unjustifiable. The values for the contributing factors of this RCA are opposites with the values of the other RCAs in the group.

5.2.1 Internal Contributing Factors

Internal contributing factors in the survey results are those over which the roading authority is perceived to have control. These contributing factors include the services of an asset manager, outsourcing of consultants, using the RAMM as an asset management tool, conducting customer surveys, and developing specifications. They have a great impact on the management of the maintenance of the road network.

5.2.1.1 Asset Managers

The two groups show a significant difference in employment of asset managers in the organisation. A substantial number of RCAs in the PBS Group have asset managers to oversee operations and control roading assets. Roding engineers, roading supervisors, contract managers, contract supervisors, works managers, rural roading engineers, area engineers and consultants are under the supervision of an asset manager in 64% of the RCAs in the PBS group as shown in Table 5.3, whereas, only 29% of the RCAs in the MBS group are supervised by an asset manager. Figure 5.1 shows the duties of the positions related to maintenance of roads as stated in the questionnaire responses. The MBS RCAs conducted more inspections and audits than the PBS RCAs. The PBS RCAs concentrated more on administering contracts, supervision and management. The specific functions of the asset managers include:

1. Authorising works
2. Financial control of physical works, setting and managing budgets
3. Monitoring expenditures
4. Approving and certifying payments
5. Management/overall fiscal control

The survey results show a very low percentage of PBS RCAs performing QA audits which suggest that this duty is passed on to the consultant and contractor in a performance-base specified contract. All of the MBS RCAs give more importance to inspections and audits rather than supervision and management.

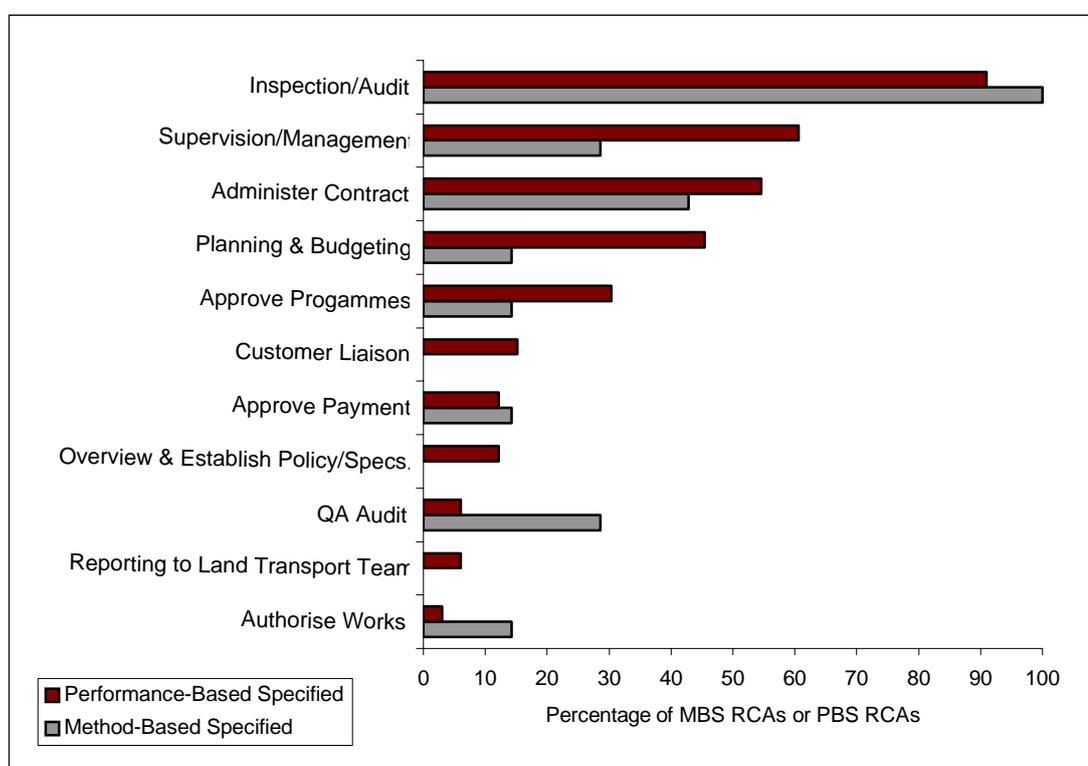


Figure 5.1. Reported duties of personnel in-charge of road maintenance.

5.2.1.2 Consultants

Survey results revealed that more than half of the PBS group used consultants outsourced by councils, whereas this figure was 29% for the MBS RCAs (Table 5.3). Services of consultants were engaged where specialist skills were required. Consultants were employed to prioritise and identify projects, manage maintenance

contracts, manage budgets, conduct random audits and regular inspections, develop specifications, and monitor levels of service.

5.2.1.3 Road Asset Maintenance Management

The use of the Road Asset Maintenance Management (RAMM) system as a technical management tool by most RCAs in the PBS Group (64%) conformed to the recognition of asset managers as a primary contributing factor based on the survey results (Table 5.3). RAMM software is mainly inventory database storage for road structures, drainage and surfacing plus condition data including skid resistance, rutting, and cracking. It contains the treatment selection algorithm (TSA), plus national optimisation of maintenance allocation by decade (NOMAD), which stores the 10 year forward works program (Transit New Zealand 1996a). The TSA was made to indicate which works should be performed in the coming year. RAMM databases are essential for the long term council community plan (LTCCP) as embodied in the Local Government Act 2002 (Wilson and Salter 2003), and are used to support applications for maintenance funding through Transfund's National Land Transport Program. Transfund's Performance Monitoring Group is tasked to review the databases as to their integrity, validity, comparison to actual road conditions, and to evaluate staff competency (Merrifield 2004). This will ensure that RCAs have good quality data that can be relied upon.

5.2.1.4 Customer Surveys

Table 5.3 shows that a great proportion of RCAs in the PBS Group (85%) relied on customer surveys. In contrast, 57% of RCAs in the MBS Group did the same. These PBS RCAs recognised the importance of ratepayers' opinions on the maintenance of the roading network. Customer surveys, conducted and analysed monthly, quarterly, yearly or at random are measures of the performance of key players in the maintenance of roads and performance of the network.

Table 5.3. Values of internal contributing factors based on survey.

Factor No.	Contributing Factors	Description	RCAs using Method Specifications		RCAs using Performance-based Specifications	
			Number	% of MBS RCAs	Number	% of PBS RCAs
			7 RCAs		33 RCAs	
1	Asset Managers	- employ asset managers	2	29	21	64
2	Consultant	- outsource consultancy services	2	29	18	55
3	RAMM	- utilise RAMM as a management tool	2	29	21	64
4	Customer Surveys	- conduct customer surveys	4	57	28	85

5.2.1.5 Specifications

This contributing factor was divided into three sub-groups as shown in Figure 5.2: (1) reliance on Transit New Zealand (TNZ) “C” Standard Specifications; (2) reliance on TNZ “C” Specifications – modified to suit local network conditions and conform to council requirements; and (3) RCAs with their own maintenance contract specifications – developed from local knowledge and experience of engineers, consultants and contractors; a collaboration of experts and resources. Review of specifications is vital before the next tendering period to incorporate changes in technology, new trends, changes in environment, best practices of other RCAs, and in conjunction with an assessment of community expectations.

The figures in this factor show a distinction between the two regimes for specifications. A significant percentage of RCAs, 85% in the MBS group, had either TNZ “C” specifications or modified TNZ “C” specifications. Only 14% had their own maintenance contract specifications. With the PBS adopters, almost half had their own maintenance contract specifications and none of them used the TNZ “C” specifications any longer. They had some sort of maturity of the specifications, using either modified specifications or new ones.

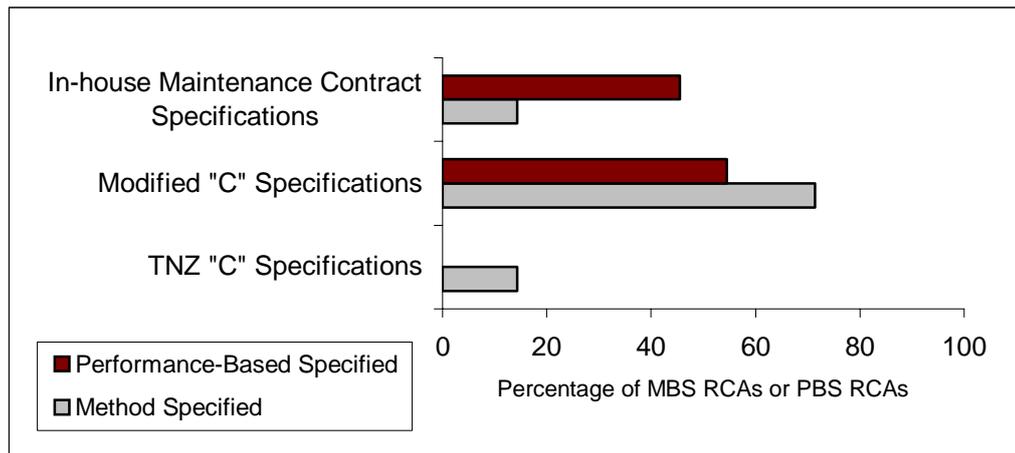


Figure 5.2. Contract Specifications.

An analysis of the survey responses on the development and improvement of maintenance specifications by New Zealand road controlling authorities is presented in Figure 5.3. The specifications were continuously modified to suit local conditions and desired outcomes, incorporating expertise and experience of technical people involved, best practices and new trends. Figure 5.4 shows the frequency of revisions

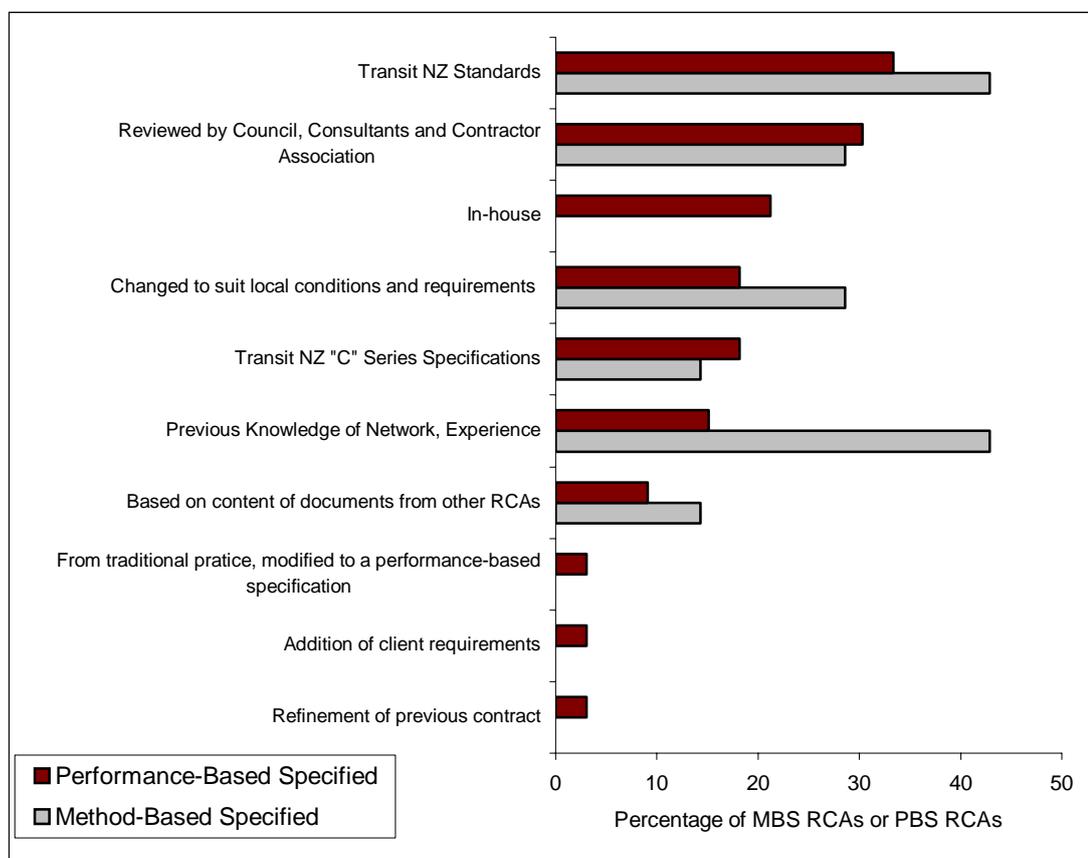


Figure 5.3. How specifications were developed.

in specifications by RCAs from the survey results. Almost 40% of RCAs in the PBS group revised their maintenance specifications as required. The other RCAs had definite schedules for review and revision, between 3 to 5 years. About 10% revised the specifications after the contract period or when there is a new contract.

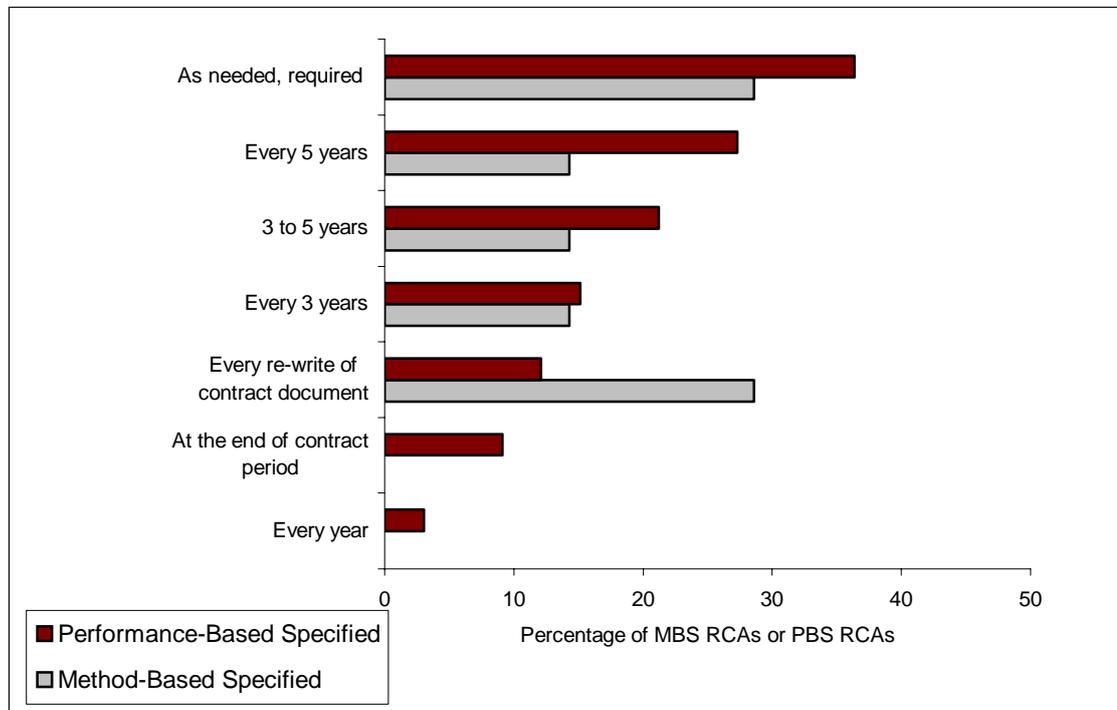


Figure 5. 4. Frequency of revisions in specifications.

5.2.1.6 Evaluation of performance of contractor

Figure 5.5 shows the mode of assessing the contractor's performance. Method specified contracts rely on monthly audits and regular site inspections more than performance-specified contracts. Evaluation of the contractor is based only on the contractor's compliance to contract specifications. Both procurement models give importance to ratepayer's feedback and 6-monthly performance reviews. In performance-specified contracts, the contractor is responsible for conducting inspections, and the engineer validates the contractor's report, giving scores for the work accomplished. This matrix can be the basis for incentives, penalties, and computation of monthly billing. A good performance by the contractor is an indication that the procurement model used is effective.

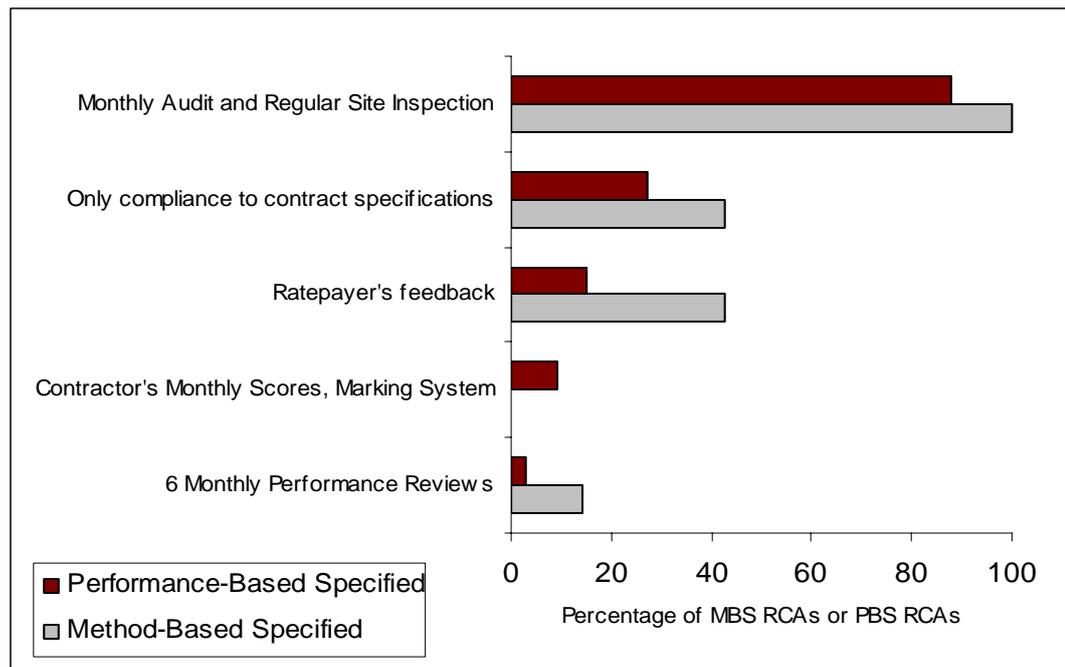


Figure 5.5. Evaluation of contractor's work.

5.2.2 External Contributing Factors

The external contributing factors were identified based on road statistics, population, and land area of TLAs²⁸. These contributing factors were classified as such because RCAs cannot influence or manipulate the values of these contributing factors. The computation of boundaries for each of the external contributing factors was discussed in Section 5.2. Tables 5.4, 5.5, and 5.6 show the summary of contributing factors based on the survey and on data from Statistics New Zealand² and local councils²⁹ using the mean, the median and the value midway between the minimum and the maximum observed values, respectively. The values in these tables were used to identify any patterns there might be for RCAs that have adopted performance-based specifications. In this case, a comparison was made on the percentage differences of MBS RCAs and PBS RCAs using the three options, for each of the external contributing factors. A summary of the percentage differences, which were ranked accordingly, is presented in Table 5.7.

²⁸ <http://www.stats.govt.nz>. Statistics New Zealand. Statistics by Territorial Local Authority. Visited 18 July 2005.

²⁹ <http://www.localcouncils.govt.nz>. Local Councils. LTCCP. Visited 15 June 2005.

Table 5.4. Values of contributing factors using the mean.

Factor No.	Contributing Factors	Mean	RCAs using Method Specifications (6 RCAs)		RCAs using Performance-based Specifications (33 RCAs)		Difference
			Number	% of MBS RCAs	Number	% of PBS RCAs	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	5-7
7	Annual Maintenance Expenditure /road km	< \$7690	5	83	18	55	28
8	Rates/road km	< \$3710	4	67	19	58	9
9	Revenue/road km	< \$8350	4	67	18	55	12
10	% Rural Road	> 86.83%	3	50	21	64	14
11	% Unsealed Rural Roads	> 50.35%	3	50	17	52	2
12	Total % Unsealed Road	> 44.61%	3	50	17	52	2
13	Road Length per Engineer (km/engineer)	> 628.33	4	67	13	40	27
14	Road Density (km/km ²)	< 0.38	3	50	17	52	2
15	Population Density (persons/ km ²)	< 10.29	4	67	20	61	6
16	Persons/road km	< 24.24	4	67	18	55	12

Table 5.5. Values of contributing factors using the median.

Factor No.	Contributing Factors	Median	RCAs using Method Specifications (6 RCAs)		RCAs using Performance-based Specifications (33 RCAs)		Difference
			Number	% of MBS RCAs	Number	% of PBS RCAs	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	5-7
7	Annual Maintenance Expenditure /road km	< \$7010	4	67	16	48	19
8	Rates/road km	< \$3380	4	67	16	48	19
9	Revenue/road km	< \$7030	4	67	16	48	19
10	% Rural Road	> 89.26%	5	83	18	55	28
11	% Unsealed Rural Roads	> 51.70%	3	50	17	52	2
12	Total % Unsealed Road	> 45.07%	3	50	17	52	2
13	Road Length per Engineer (km/engineer)	> 550	4	67	15	45	22
14	Road Density (km/km ²)	< 0.37	3	50	16	48	2
15	Population Density (persons/ km ²)	< 6.76	4	67	15	45	22
16	Persons/road km	< 21.49	4	67	16	48	19

Table 5.6. Values of contributing factors using midway between the minimum and maximum.

Factor No.	Contributing Factors	Midway (Min & Max)	RCAs using Method Specifications (6 RCAs)		RCAs using Performance-based Specifications (33 RCAs)		Difference
			Number	% of MBS RCAs	Number	% of PBS RCAs	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	5-7
7	Annual Maintenance Expenditure /road km	< \$9910	5	83	25	76	7
8	Rates/road km	< \$5790	6	100	27	82	18
9	Revenue/road km	< \$1093	5	83	24	73	10
10	% Rural Road	> 78.79%	6	100	27	82	18
11	% Unsealed Rural Roads	> 47.80%	5	83	19	58	25
12	Total % Unsealed Road	> 44.44%	4	67	17	52	15
13	Road Length per Engineer (km/engineer)	> 891.43	3	50	5	15	35
14	Road Density (km/km ²)	< 0.40	3	50	19	58	8
15	Population Density (persons/ km ²)	< 17.36	4	67	27	82	15
16	Persons/road km	< 35.38	4	67	25	76	9

Ranking the contributing factors using the three options, Table 5.7, shows fairly consistent findings. The ranking had been investigated further to find out which of the contributing factors are constantly within the top 3, top 4, and top 5 of the list.

Table 5.7. Ranking the contributing factors using three options.

Rank	Mean		Median		Midway (Min & Max)	
	Factor No.	Difference	Factor No.	Difference	Factor No.	Difference
1	7	28	10	28	13	35
2	13	27	13	22	11	25
3	10	14	15	22	8	18
4	9	12	7	19	10	18
5	16	12	8	19	12	15
6	8	9	9	19	15	15
7	15	6	16	19	9	10
8	11	2	11	2	16	9
9	12	2	12	2	14	8
10	14	2	14	2	7	7

In investigating the data, it was found there are big differences in the percentage of MBS RCAs and PBS RCAs in three out of three cases for contributing factor 13 (road length per engineer) and two out of three cases for contributing factor 10 (% rural road), when the top three factors were considered. Contributing factors 10 and 13 came out in all three cases when the top four were analysed, whereas, contributing factor 7 (annual maintenance expenditure/road km) appeared in two out of three cases. It was also observed on the next level ranking that contributing factors 9 (revenue/road km) and 8 (rates/road km) turned up in two out of three cases.

It appeared in the analysis that a greater percentage of the RCAs adopting performance-based specifications had more percentage rural roads than the rejectors (MBS RCAs). The adopters of performance-based specifications, PBS RCAs, seem to be associated with having less road length per engineer. The adopters had more engineers to oversee road network maintenance since they have more remote roads as seen in the rural road percentage. This implies that RCAs in the PBS group have more resources, illustrated by the number of engineers involved in the maintenance of local roads. Engineers of RCAs in the MBS group had a greater length of road to look after and may not have had the time or inclination to make the change to performance-based specifications.

The PBS RCAs seemed to have higher rates and revenue per road kilometre. Consequently, the annual maintenance expenditure per road kilometre was higher than that of the MBS RCAs.

.....

Chapter 5 presented the survey of road controlling authorities. The survey responses were used to identify those RCAs that had adopted performance-based specifications and those that still use method specifications. The contributing factors, both internal and external were discussed.

In observing the PBS RCAs, it was found that they had more resources in terms of rates and revenues. They placed more importance on the whole road network as they

spent more money, had asset managers, engaged consultants for specialised skills, employed more engineers, had highly developed specifications and conducted customer surveys.

In general, it is implied that the RCAs that are more likely to adopt performance-based specifications will have the following characteristics:

1. Employ asset managers to be in charge of the overall maintenance of the roading network;
2. Outsource consultants providing specialist skills;
3. Use maintenance management tools like RAMM;
4. Conduct customer surveys to know ratepayers' opinions, thus, validating the effectiveness and efficiency of the maintenance of the network;
5. Have written and modified their own maintenance specifications;
6. Have more resources in terms of rates and revenue per road kilometre;
7. Have more annual maintenance expenditure per road kilometre;
8. Have a higher percentage of rural roads;
9. Have less road length per engineer;
10. Evaluate contractor's accomplishments on the basis of performance required of the road network by using a marking and scoring system.

The contributing factors and the possible impeding factors have been discussed. These factors will be used in the following chapter to set the atmosphere for the transition stage in the Philippines, managing change from the prescriptive method specifications to performance-based specifications.

5.3 References:

Merrifield, R. (2004). "RAMM databases to be reviewed." *Transfund News*, Issue 61. Wellington.

Robinson, R., Danielson, U., and Snaith, M. (1998). *Road Maintenance Management*, Palgrave, New York.

Transit New Zealand. (1996). *State Highway Asset Management Manual*, Transit New Zealand, Wellington.

Wilson, V., and Salter, J. (2003). *A Guide to the Local Government Act 2002*, DSL Publishing, Wellington.

6 TRANSITION – MANAGING CHANGE

6.1 Introduction

The internal and external contributing factors for the adoption of performance-based maintenance contracts in New Zealand were investigated and analysed in the previous chapter. Subsequent sections will discuss the transition stage, managing the change from method specifications to performance-based specifications in the Philippines.

The Department of Public Works and Highways (DPWH) in the Philippines initiated reforms in the operation and management of the road network with the inception of the Road Information and Management Support System (RIMSS) in 1997. Through the World Bank funded National Roads Improvement Project (NRIMP), three long-term performance-based maintenance pilot projects were implemented in 2002. Performance-based maintenance, which included routine and periodic maintenance activities, was one of the three components for these pilot projects. The other two components included annual preventive maintenance and maintenance back-log reduction.

The researcher gathered first-hand information on the on-going reforms in the DPWH through a meeting with Director B. Elizabeth E. Yap, RIMSS-PO Deputy Project Director and Diane Wacker of D.Michael Cleary and Partners, Inc., RIMSS Integration and Coordination Consultant. The meeting was held at the office of Director Yap, DPWH-Central Office, Manila, on 14 December 2005. An interview was also conducted with the project engineer of pilot project LTPBMC 2a, Engineer Ernante Antonio of the DPWH-Bureau of Maintenance, where the researcher obtained feedback on the implementation of the performance-based maintenance pilot projects. The interview was conducted on 14 December 2005 at the DPWH-Bureau of Maintenance, Manila.

6.2 *Internal Factors*

6.2.1. Asset Managers

The role of an asset manager in road authorities in the Philippines to oversee the management of roading assets is important. The asset manager has total operational and fiscal control of roads. The role of the asset manager includes defining activities, planning, allocating resources, organising and motivating personnel, controlling work, monitoring and evaluating performance and feeding back results to seek improvement (Robinson et al. 1998). In the Philippine setting, these functions are present in the Central, Regional and District offices of the DPWH and local road authorities, however, these tasks are performed separately by specialised staff under the supervision of the Head of Office. Consolidation of these functions, to be handled by an individual, is necessary for effective and efficient management of the roading asset.

Roads have to be maintained in an acceptable condition to obtain value for money and to reduce vehicle operating costs. This is where the role of a roading asset manager comes in, to identify and prioritise projects within a given budget without compromising the needs and safety of stakeholders.

6.2.2 Consultants

There are a number of consulting firms, both domestic and foreign, that offer professional services for the management of roads in the Philippines. Under Republic Act Number 9184, the client is assured high quality service as these consultants are accredited and monitored by an umbrella of consulting organizations, the Confederation of Filipino Consulting Organizations (COFILCO)³⁰. Member

³⁰ <http://www.cofilco.org/about.asp>. Confederation of Filipino Consulting Organizations. Visited 23 September 2005.

consulting firms that offer professional services for the management of roads include the following:

- ❖ Council of Engineering Consultants, Inc. (CECOPHIL) – composed of corporations which include domestic and foreign consultants
- ❖ Association of Consultant Civil Engineers of the Philippines, Inc. – composed of consulting firms principally engaged in branches of civil engineering including roads, bridges, portworks, etc.
- ❖ Construction Project Managers Association of the Philippines, Inc. – specializes in construction management and supervision of infrastructure projects.

There are many local consultants in the Philippines but most lack skills in asset management. The local consultants have to compete with foreign consultants. Most consultancy services in the DPWH are awarded to foreign consultants because of the expertise and advanced technology these consultants introduce to the road agency. The employment of foreign consultants is usually one of the conditions for foreign-funded projects or foreign loans. In some cases, foreign consultants are awarded contracts because they are pre-qualified for bidding, and local contractors cannot compete with them because of a lack of resources and experience. With this situation in the Philippines, strengthening the local consulting industry is imperative to make them competitive in the industry. Employing local consultants will help local employment and at the same time save costs on foreign exchange.

6.2.3 Road Asset Maintenance Management

Road asset managers in New Zealand currently use the Road Asset Maintenance Management (RAMM) system as a technical management tool having high quality inventory data covering road network conditions and history of maintenance activities. Likewise, the Road Information Management and Support System (RIMSS)³¹ project was developed in the Philippines to improve support for decision-making through the provision of modern analytical tools and efficient modern

³¹ www.dpwh.gov.ph/reforms/rimss/index.htm. Department of Public Works and Highways. RIMSS Overview. Visited 7 September 2005.

information technology. The DPWH is now in the process of training engineers in pavement management systems (PMS), which provide needs analyses, multi-year programming and budgeting. They are used for evaluating various scenarios and generating data required for long-term plans for road development and preservation. The extent of implementation of PMS will depend greatly on the availability of traffic and road condition data, which is available through the Road and Bridge Information Application³² (RBIA) of the DPWH. Domingo (2002) developed a simple and practical PMS for the local road network in the Philippines. The proposed PMS included techniques on prioritising road maintenance projects using the pavement condition index, taking into consideration the severity and type of distress.

RBIA has information related to inventory consisting of the visual condition assessment, roughness, video imaging, pavement strength, pavement thickness, centreline survey, and skid resistance (Department of Public Works and Highways March 2004). The challenge faced by the DPWH was the expense of outsourcing the collection of special surveys, which was expensive. The special surveys that need specialised equipment are those like roughness, centreline surveys, highway imaging, local referencing of road and bridges, pavement strength, pavement thickness, and skid resistance (Department of Public Works and Highways April 2004). The consultant looked into in-house data collection for some of the special surveys but did not have great success due to logistical problems: there was sufficient training of DPWH engineers to collect data but the available equipment were not well maintained, and/ or there were problems obtaining equipment with the basic requirements (e.g. vehicle with odometer). In some field offices, data collection had not been finished for a cycle (usually 1 year), and they were already behind in the next cycle. The DPWH thus opted to outsource special surveys to consultants or contractors.

The availability of relevant, up-to-date, and accurate inventory data of the road network is imperative, not only for the road authority but also for the contractor. The road agency uses the data to benchmark the condition of the network at the beginning of the contract. The data can be used to assess the risks transferred to the contractor

³² http://www.dpwh.gov.ph/imprvmnt_areas/road-bridge_info.htm, Department of Public Works and Highways. Road and Bridge Information Application. Visited 31 January 2006.

with the implementation of a performance-based contract, and find ways to mitigate them. At the tendering stage, the contractor must know the present condition of the network and understand the risks involved.

6.2.4 Customer Surveys

The DPWH has a Complaints and Action Center (CAAC) to receive complaints, queries, requests for assistance, opinions, suggestions and recommendations. The CAAC is a means of reaching out to the public and encouraging interaction with stakeholders. Obtaining data through CAAC is one way of improving service delivery to the public. To give meaning to these data, the DPWH should encourage CAAC to conduct and analyse customer surveys to determine significant changes in the system. Results from the analyses are useful tools for roading asset managers to evaluate the effectiveness and efficiency of the management systems.

The Secretary of the DPWH recognised the importance of customer's views on the management of the roading asset. He said that "In pursuing the national infrastructure plans and programs, the DPWH will continue to rely on the voice of the people and turn concerns into opportunities for better management strategies."³³

It is acknowledged that involving ratepayers in the maintenance management of the road network is important to obtain feedback. At the same time, the road users and other stakeholders (i.e. politicians) ought to be well informed and educated on the implementation of performance-based maintenance contracts. The road users have to know what to expect from the road agency and the contractor.

6.2.5 Specifications

The DPWH has three types specifications used for the maintenance of national roads and still uses the activity standards on the Philippine Highway Maintenance Management System for routine maintenance.

³³<http://www.dpwh.gov.ph/News/2005/apr%20may%20jun.asp#road%20confab>. Department of Public Works and Highways. DPWH Chief stresses Quality Roads during Road Engineers Confab. Visited 15 October 2005.

The DPWH has its standard specifications (Department of Public Works and Highways 1995) for the construction and maintenance of national roads, widely adopted by local road authorities. The specifications are prescriptive, giving details on the methods of construction, materials, equipment and basis of payment for specific items of work. The standard specifications, generally known as “the Blue Book”, come in three volumes. Volume 2, specifically for highways, bridges, and airports, comprises nine parts.

1. Part A - Facilities for the Engineer, which includes offices, laboratories, vehicles and assistance to the engineer;
2. Part B - Other General Requirements such as offices, shops, stores and workmen’s accommodation for the contractor, and medical room and first aid facilities;
3. Part C – Earthwork;
4. Part D – Subbase and Base Course;
5. Part E – Surface Courses;
6. Part F – Bridge Construction;
7. Part G – Drainage and Slope Protection Structures;
8. Part H – Miscellaneous Structures;
9. Part I- Materials Details.

The specifications in the Blue Book were used for maintenance activities or items of work not covered in the activity standards³⁴ for the Philippine Highway Maintenance Management System. The specifications and activity standards are used for in-house routine maintenance, periodic maintenance, and small maintenance contracts involving combined routine and periodic work. The activity standards provide details on the description, purpose, and scheduling of maintenance activities. They are prescriptive as they give particulars to the typical crew, typical equipment, typical materials and typical work methods for maintenance activities.

³⁴ Ministry of Public Works and Highways. Revised 1985. List of Activity Standard on the New Highway Maintenance Management System.

The Bureau of Maintenance of the DPWH had been using specifications which formed part of the Maintenance by Contract Manual (Kampsax International A/S 1991). Section K of the manual has 42 method specifications for the maintenance of unpaved road and shoulder surfaces, bituminous surfaces, concrete surfaces, base materials, and replacement of pavement. The specifications were used for the implementation of routine and periodic maintenance by contract projects.

The consultant for the study on the long-term performance-based maintenance contracts (LTPBMC), Kampsax International, developed performance-based specifications for the pilot projects in the Philippines³⁵. The performance-based specifications were included in the study conducted by Kampsax International A/S (1999). The LTPBMC pilot projects were awarded in 2001 but only commenced in 2002. The specifications had to be reviewed to consider changes in the road network from the time of the study to the implementation of the projects. The specifications were reviewed by BCEOM Société Française d'Ingénierie, the in-house consultant of the Bureau of Maintenance for the implementation of the pilot projects. The performance specifications, which were part of the tender documents, had general specifications that covered the required activities, construction method, traffic management, environmental management, materials and testing. Aside from general specifications, performance requirements for individual maintenance activities were also discussed in detail.

6.3 External Factors

As just shown, the Philippines is generally well prepared to adopt performance-based specified maintenance contracts as far as comparing the internal contributing factors with those of New Zealand is concerned but there is a great contrast between the Philippines and New Zealand relative to the external factors.

The Philippines has about 10% more land area than New Zealand, and the population is twenty times as much. The total length of roads in the Philippines is more than

³⁵ A copy of the performance specifications and requirements was obtained from Bureau of Maintenance OIC Director Luis A. Mamitag, Jr., through Ms. Elizabeth P. Pilorin, OIC-Public Information Division, DPWH. Copy received 18 October 2005.

twice as much as in New Zealand but only a third as much is paved. All state highways and almost 60% of the local road network are paved in New Zealand. In the Philippines only 70% and 15% are paved for the national roads and local roads, respectively.

Road density in the Philippines is twice as much as that of New Zealand. Vehicle abundance per km² and motor vehicle ownership in New Zealand is about three times and eighteen times more than the Philippines, respectively (refer to Table 2.1). This is an indication that there are more low-volume roads in the Philippines, more roads yet a lesser number of vehicles. New Zealand has fewer roads yet they carry more traffic. New Zealand roads are exposed to a wider temperature range. Ms. Wacker acknowledged the differences of the road network and road users in the Philippines and New Zealand. Roads in New Zealand are of better quality than most Philippine roads.

There is no ideal organisational structure. The structure for road management is not a one-size fits all entity, but in this case, the Philippines can apply the best practices in New Zealand in terms of the adopting performance-based specified contracts. Basically, the maintenance is equally important to both countries despite the fact that there are huge differences as far as external factors are concerned.

In the previous chapter, the contributing external factors were investigated and identified. There were at least five key external factors that made the adoption of performance-based specified contracts easy for RCAs: 1) road length per engineer, 2) % rural road, 3) annual maintenance expenditure per kilometre, 4) revenue per road kilometre, and 5) rates per road kilometre.

In New Zealand, the engineers of most PBS RCAs manage lesser road lengths (<600 km/engineer) than the MBS RCAs. The DPWH maintenance engineers are managing an average of 160km of road per engineer³⁶. This figure is far below the length of roads managed by engineers in the New Zealand PBS RCAs. As shown earlier in section 4.4.1, the Philippine pilot projects, which were managed by the project

³⁶ Figures were computed from the length of national roads and assuming one maintenance engineer each for the 167 DPWH District Offices.

engineers, had lengths ranging from 33 to 112 kilometres. The Philippines has a great advantage on the adoption of performance-based specified contracts, as far as this contributing external factor is concerned.

In Section 5.5.2 it appeared in the analysis that the RCAs adopting performance-based specifications had a higher percentage rural roads than the rejectors (MBS RCAs). The PBS RCAs had more engineers to oversee road network maintenance since they had more remote roads as seen in the rural road percentage. The pilot projects in the Philippines completed in 2005, showed positive outcomes on the adoption of performance-based specifications on highly trafficked main arterial roads. In the case of New Zealand, it appeared that there was also great success for this type of maintenance management system when applied to rural and unsealed roads. It was a matter of defining the desired levels of service for the different types and hierarchy of roads. As mentioned earlier, there is no ideal organizational structure, at the same time, there is no ideal performance specification that is applicable to all types of road.

The analysis in Chapter 5 showed that the rates and revenues per road kilometre are important to the adoption of performance-based specifications. The road rates and revenues have a great effect on the annual maintenance expenditure. To attain success in adopting the change, the availability of sufficient funding must be established. This is one of the bases for setting the required minimum level of service, the size of the contract, and the duration of the contract.

It is recognized that there is a need to upgrade the road network to cope with higher levels of service required by customers due to traffic growth and the changing type of traffic. In the future, road users will expect more from the road network to support social and economic activities. Thus, road authorities in the Philippines must update the needed performance specifications to be responsive to the expectations of the ratepayers. The performance specifications should be attainable, realistic, and measurable. With the reforms introduced through the RIMSS project, proper planning and prioritization of projects will be achieved and correspondingly, funds will be optimised and managed properly.

6.4 Policies and Reforms

The Local Government Act (2002) of New Zealand requires road controlling authorities to maintain the roading network based on desired community outcomes. The government supports this endeavour through the Land Transport Management Act. Transit New Zealand has developed the State Highway Asset Management Manual (Transit New Zealand 1996) and RCAs are required to prepare asset management plans. On the other hand, the Philippine government is guided by the Philippine Transport Strategy³⁷ and supports reforms in the DPWH.

The DPWH developed a Highway Management Plan that initiated the creation of a comprehensive Road Information Management Support System (RIMSS). Its primary purpose is to change business practices within the DPWH to be in line with the trend in progressive road authorities around the world. These business practices will include separating the road-related functions of the DPWH from its non-road activities and focusing more on road users' needs, re-allocating DPWH service functions to contractors by outsourcing its management and maintenance activities to the private sector, and separating road maintenance and construction activities. The DPWH Road Program Office³⁸ was created in 2000 and was tasked to 1) prepare a business plan for the Office; 2) prepare standards and procedures for local government road maintenance; and 3) prepare standard contracts for national road maintenance (long-term performance based maintenance contracts and preventive maintenance contracts).

The institutional reforms in the DPWH were implemented by the RIMSS through Business Improvement Implementation Projects (BIIPs) subcomponent of the NRIMP to improve the quality and delivery of services focusing on customer needs, improved efficiency and effectiveness, and use of information technology (D. Michael Cleary and Partners Inc. 2003). The processes and procedures for long-term network planning and multi-year programming and scheduling are incorporated in

³⁷ <http://www.adb.org/documents/cosss/phi.pdf>. Asian Development Bank. Philippine Transport Strategy (1997) Technical Assistance to the Republic of the Philippines for Rural Road Development Policy Framework. Visited 29 September 2005.

³⁸ Department of Public Works and Highways Department Order No. 249 Series 2000 dated 27 December 2000, Annex "C".

the Highway Planning Manual (Department of Public Works and Highways 2003), which was created through the NRIMP.

The DPWH is currently conducting training with technical courses, business and management courses and employee development courses. It was acknowledged by the DPWH Secretary that engineers lack skills in road asset management. Provision of appropriate training for DPWH personnel as well as local contractors and consultants is critical to the improvement of road administration and privatisation efforts. The DPWH Secretary urged local contractors and consultants to be generally responsible for the training of personnel in their respective projects.³⁹

During the implementation of the LTPBMC pilot projects, three engineers who were trained for the pilot projects left the DPWH for reasons beyond the control of the agency. BCEOM Société Française D'Ingenierie (2005) recommended in the completion report that the Bureau of Maintenance should ensure that project staff with expertise in performance-based maintenance contracts are retained in the agency. The DPWH should tap the skills of the trained engineers to transfer technology to other regions and district offices.

6.5 Funding

The availability of sufficient funds is essential for the success of the management of the maintenance of road networks. In New Zealand, the preservation of local road assets is funded from rates and revenues collected by local councils and is subsidised by Land Transport New Zealand (LTNZ) formerly Transfund. The state highways are funded by LTNZ. In the Philippines, the maintenance of local roads is funded from rates, known as the internal revenue allotment (IRA), and is subsidised by the national government. The funds for the maintenance of national roads come from the national government through the Philippine Road Board and foreign loans (foreign-assisted projects).

³⁹ http://www.dpwh.gov.ph/News_index.asp#Ebdane. Department of Public Works and Highways. Reports on Training Needs for DPWH Engineers. Visited 15 October 2005.

The Philippine Road Board was created under Republic Act 8794 (Philippine Road Board 2001). The functions of the board include: a) operations of special funds, b) management of special funds, c) approval of work programs, d) approval of special budgets, e) review of work programs, f) complementary work programs under other funding, g) procedures for monitoring performance and managing programs, h) approval of contracting methods, i) utilisation of the special funds, j) public awareness and reports, and k) supervisory authority.

The main purpose of the Philippine Road Board is to operate and manage special funds from the Motor Vehicles Users' Charge (MVUC) and overloading penalties. The special funds are primarily used for the maintenance of national roads, improvement of drainage along national roads, maintenance of local roads, road safety and pollution control. Eighty percent of the revenue is intended for national roads while only five percent is allocated for local roads (Philippine Road Board 2001). It appears that the government has given more emphasis to the maintenance of national roads compared to the local roads, although figures showed that local roads account for 85 % of the total road network. The government should consider the importance of local roads as pillars of economic development. The ratepayers do not only need new roads but they also need sustainable and well-maintained roads for accessibility and mobility for daily activities. It is recommended to review the funds allocated for the national roads and local roads. There should be proper management and distribution of funds to be able to sustain the road network for future generations.

.....

Improving low-volume road maintenance in the Philippines based on a New Zealand experience prompted the researcher to study the management of change to the adoption of performance-based specifications. A research proposal was submitted in August 2004. The researcher then learned about the LTPBMC pilot projects in January 2005, during the "home located research" in the Philippines. Consequently, some changes in the outline of the thesis had been made to link the pilot projects to

the study. The lessons learned from the survey conducted on RCAs in New Zealand and reports on the completed pilot projects have been analysed and investigated. The analysis was used to determine the contributing factors for the adoption of performance-based specification for unsealed low-volume roads in the Philippines.

The Philippines is moving forward and is improving road maintenance to be in line with the trend in progressive road authorities around the world. The DPWH through the RIMSS has developed systems to improve quality and delivery of services by initiating a more customer-driven culture and establishing a coherent and diverse organisation. The LTPBMC pilot projects demonstrated a positive outlook on the adoption of performance-based specifications. Likewise, the reforms relative to road maintenance that were in operation, were effective tools that facilitated the management of change. The success of the projects convinced the consultant to recommend longer terms and longer lengths of road to be considered for future performance-based maintenance contracts.

Domingo (2002) proposed a simple PMS for local roads in the Philippines. If this system is accepted, it will a basis for local road authorities to consider adopting performance-based specifications since the PMS will have the road inventory needed, the types of treatment and prioritisation of road maintenance projects. It is recommended that performance-based specification be applied to low-volume roads on a small scale so that it will be easier for local engineers to manage and cope with the limited resources of local road authorities. The smaller contracts would also help the small contractors in the industry, and generate employment in the local government units.

Managing the change is a challenge. To attain full implementation of performance-based specifications, the government must support the program and be open-minded to the transformation to the new system. The Philippine road network will be sustainable through the provision of sufficient funding, employment of skilled asset managers, provision of appropriate training to DPWH and local road authority engineers, provision of adequate information technology resources, involvement of

road-users and stakeholders, and having confidence in local consultants and local contractors.

It would take time and a lot of funding to prepare local roads in the Philippines to change to performance-based specifications. Assuming that all the resources are in place, the road authorities would be confronted with the problem of the present condition of the roads, whether they are maintainable or not. The local roads must be in good condition to be able to see the effectiveness of the system in place. In the case of the pilot projects implemented, preventive and catch-up routine maintenance were included to reduce the maintenance backlog. After the roads were brought up to good condition, the performance-based maintenance component started.

With New Zealand in the forefront of performance-based specified contracts and the Philippines in the initial stage of adoption, a comparison of performance-based specifications will be discussed in the succeeding chapter.

6.6 References:

- BCEOM Société Française D'Ingenierie. (2005). "Completion Report for Consulting Services for the implementation of of the Long-term Performance-Based Maintenance Project." BCEOM Societe Francaise D'Ingenierie. Manila.
- D. Michael Cleary and Partners. (2003). "Annual NRIMP-1BIIPs Subcomponent Benefits/Cost Monitoring Report with Initial Baseline Measures and Values." D. Michael Cleary and Partners, Inc. Manila.
- Department of Public Works and Highways. (1995). *DPWH Standard Specifications*, Department of Public Works and Highways. Manila.
- Department of Public Works and Highways. (2003). "Highway Planning Manual." Department of Public Works and Highways. Manila.
- Department of Public Works and Highways. (April 2004). "Manual for Road Data Collection Special Surveys." Department of Public Works and Highways. Manila.
- Department of Public Works and Highways. (March 2004). "Road Data Collection, Quality Assurance and Management Manual." Department of Public Works and Highways. Manila.

- Domingo, R. C. (2002). "Adopting A Pavement Management System (PMS) for Local Governments." *A Compendium of Graduate Theses in Transportation (1993-2003) National Center for Transportation Studies, University of the Philippines Diliman*, 81-86.
- Kampsax International A/S. (1991). "Maintenance by Contract Manual, Third Edition." Kampsax International A/S. Manila.
- Kampsax International A/S. (1999). "Advisory Consulting Services for the Study on the Long-term Performance-Based Maintenance Contracts." Kampsax International A/S. Manila.
- Philippine Road Board. (2001). "Philippine Road Board Operating Procedures Manual." Philippine Road Board. Manila.
- Robinson, R., Danielson, U., and Snaith, M. (1998). *Road Maintenance Management*, Palgrave, New York.
- Transit New Zealand. (1996). "State Highway Asset Management Manual." Transit New Zealand. Wellington.

7 COMPARISON OF PERFORMANCE-BASED SPECIFICATIONS IN NEW ZEALAND AND THE PHILIPPINES

7.1 Introduction

Developing performance-based specifications consists of several key steps that include: a) identifying functional road requirements, b) identifying the required level of service, c) determining performance acceptability and compliance, d) setting remedies, incentives and penalties, e) developing a quality assurance plan to determine how performance will be measured⁴⁰. Performance specifications will need to guarantee the quality and durability of the end product. The criteria for performance specifications which define the outcomes include roughness, surface texture, skid resistance, rutting, and pavement strength for sealed and unsealed roads. Corrugations and minimum level of dust are also included for unsealed roads.

Performance specifications are the basis of determining whether the contractor is conforming to the terms and conditions of the contract. The contractor is paid on the basis of the performance requirements regardless of the quantity of the actual items of work accomplished (Kampsax International A/S 1999). The performance specifications incorporate requisites like scope of work activities, performance criteria, response times, traffic management, environmental management, and basis of payment. The performance-based specifications for the LTPBMC pilot project in the Philippines also included construction methods or proposed methods of repair, materials, equipment and testing requirements. Since performance-based maintenance was new to the industry, contractors needed a guide or benchmark to comply with performance requirements. There are 2 key elements identified for a performance-based specification: “a definition of the performance required and a requirement that a defined performance shall prevail over a suitable period of time” (Hardy 2001). It is essential for performance specifications to be customised to the

⁴⁰ <http://www.mercury-assoc.com/resources/performance-based-specifications.pdf>. Mercury Associates Inc. Dave Robertson. 2003. How to Develop Performance-Based Specifications. Visited 6 May 2005.

specific needs of a particular area while maintaining consistency of service across the road network⁴¹. Performance targets must be realistic and easily measured.

7.2 Elements of a Performance-Based Specification

7.2.1 Scope of Work

The scope of work is an introduction to the performance specification and describes the title of the specification. It enumerates required activities that give details on particular tasks to be accomplished by the contractor.

7.2.2 Performance Criteria

This section specifies the criteria used to measure the performance of the contractors citing the level of service required of the road network. The performance criteria give details on the condition of the pavement, e.g. roughness, surface texture, skid resistance, rutting, size of potholes, height of vegetation, extent and severity of pavement distress, cross-fall, corrugations, maximum level of dust for unsealed roads, and visibility of pavement markings and road signs.

7.2.3 Response Times

The maximum tolerable time to correct defects and deficiencies of the pavement and roadside structures are set out as a basis for penalties and incentives to contractors. The response time depends on the type of road, road classification, traffic volume, severity and magnitude of defect, and the dangers that can possibly affect the safety of the road user. Response times can be specified in hours, days, weeks, months, or at all times.

⁴¹ <http://www.highways.gov.uk/roads/projects/dps/index.htm>. Highways Agency Developing Performance Specifications Consultation Paper. April 2003. Highways Agency Contracts and Specifications. Visited 19 June 2005.

7.2.4 Traffic Management

This section describes the traffic management scheme required for the project to reduce risks for both motorists and road workers, avoid delays and prevent traffic congestion.

7.2.5 Environmental Management

The preservation of the environment is an important aspect in the maintenance of the road network. The contractor is required to develop an environmental plan on how to maintain a sustainable environment by specifying measures for its preservation and the proper disposal of construction wastes and debris.

7.2.6 Basis of Payment

This section gives information on how the contractor's monthly accomplishment is evaluated. Payment to the contractor is based on the compliance to performance required, work considered complete based on specifications, the complaints received by the engineer, and other conditions identified by the road authority as stipulated in the contract.

7.2.7 Construction Methods or Proposed Methods of Repair

The detailed activities to be performed in order to accomplish certain tasks are stated in sequence in this section. It gives references to the DPWH Standard Specifications for Highways, Bridges and Airport⁴².

7.2.8 Materials

Suitable materials to be used for the activity are given in this section. The physical properties and composition of the materials are specified. This gives the contractor

⁴² Department of Public Works and Highways. 1995. DPWH Standard Specification for Highways, Bridges and Airport, Volume II. Manila.

the option to use high quality materials from different sources but of comparable properties.

7.2.9 Equipment

Appropriate equipment used to carry out the maintenance activities are defined to achieve best results in the maintenance of the road network.

7.2.10 Testing Requirements

Test requirements for materials, such as AASHTO⁴³ standard tests and test frequency are the main components of this section. The sampling of materials, type and number of tests performed depend much on the kind of material and the quantity incorporated into the work.

7.3 Performance-Based Specifications in New Zealand and the Philippines

New Zealand road authorities have been accumulating experience with performance-based specifications since the late 1990s, making them experts in the field, while the Philippines is still in the primary stage. Over the years, transportation engineers in New Zealand have been continuously developing and modifying performance specifications to comply with stakeholder needs, local road conditions, climate and geographic conditions, and changing levels of service required. The difference in the performance-based specifications in both countries is a result of varied expertise of engineers, local conditions, desired levels of service, years of experience, and availability of resources.

The contractor must be motivated to perform well and sustain a long-term contract. In order to achieve this, New Zealand performance specifications have incentives for contractors for good performance and productivity improvement and at the same

⁴³ Department of Public Works and Highways. IBRD-NRIMP Long Term Performance Based Maintenance Contracts. LTPBMC 2b Bidding Documents. Section 5 – Specifications.

time impose tough penalties for non-compliance. The performance specifications encourage contractors to be proactive in implementing maintenance works by giving incentives and encouraging appropriate use of resources. The performance specifications for the LTPBMC pilot projects prepared by the consultant in the Philippines incorporated penalties to be imposed on contractors for non-conformity. The penalties were stipulated in the matrix used by the Project Engineer when conducting monthly inspections and deducted from the monthly lump sum payment to the contractor.

The performance specifications in New Zealand have evolved to cover all aspects relative to road asset management. This is due to the advance of technology and the abundance of engineers with technical expertise and experience in the field. Performance appraisals, which are noted on a network score card, are made on four major components: management performance measures, key performance measures, operational performance measures, and contract performance measures. Management performance measures set out processes that apply to the planning management and implementation of the contract. They cover the contract quality plan, contractor's program, contractor's report, contractor's customer care, and traffic management plan. Key performance measures illustrate the overall condition and function of the road network. They describe the drivers for periodic maintenance and rehabilitation programmes of the contractor, which include network reliability, surface texture, skid resistance, and roughness. Table 7.1 illustrates the key performance measures currently adopted for Transit New Zealand's performance-based specified maintenance contracts. Operational performance measures associate with the daily activities on the road network that define routine maintenance and emergency response programs. They provide details on contract standards and response times (see Table 7.2) for pavement maintenance, shoulder maintenance, detritus, drainage system maintenance, bridge maintenance, roadside structure maintenance, vegetation, lighting, road sign and pavement marking maintenance. Contract performance measures are records of all information and data pertaining to the contract, which are the bases the consultant uses to update the network scorecard.

Table 7.1. Key Performance Measures for Transit New Zealand's Performance-Based Specified Maintenance Contracts⁴⁴

Parameter	Key Performance Measures	Details Of Measurement
Roughness	Percent with roughness >NAASRA ¹ threshold	Annual with HSD ²
Texture	Percent with mean texture depth <lower threshold	Annual, mean profile depth with HSD ²
Texture	Percent with mean texture depth >upper threshold	Annual, mean profile depth with HSD ²
Skid Resistance	Percent with Sideways Force Coefficient <threshold	Annual, using SCRIM ³ compatible
Rutting	Percent with depth >20mm	Annual with HSD ²
Surface Life	Minimum surface life index	Years 8-10 only, an empirical index based on expected life for different surface types
Structural Condition	Structural condition index	Years 3, 6, 8 and 10. Volume of overlay required across network to achieve a 25 year pavement design based on FWD ⁴ back analysis
Minimum resurfacing length	Resurfacing length by lane-km	Annual, proposed by tenderer, chip seal and AC surfacings
Minimum rehabilitation length	Rehabilitation length by lane-km	Annual, proposed by tenderer

¹NAASRA (National Association of Australian State Road Authorities) has an accepted unit of measure of road roughness

²HSD (High Speed Data) using laser profilometers

³SCRIM (Sideways Force Coefficient Routine Investigation Machine)

⁴FWD (Falling Weight Deflectometer)

In the Philippines, the performance specifications used for the LTPBMC pilot contracts were developed by the consultants to meet the requirements based on the present condition of the network, minimum level of service, road use and traffic condition.

The performance specifications for New Zealand consider customer complaints when a contractor's accomplishment for monthly payment is evaluated. RCAs involve ratepayers to be proactive, and actively participating in the management of roads. In the Southland District Council, one criterion measuring the performance of a contractor is the number of complaints received by the engineer during the contract

⁴⁴ <http://www.rims.org.nz/NR/rdonlyres/2C6A9E57-7CEF-4946-8E45-08BE28DF858D/0/ParkmanARRBPSMCRisks.pdf>. Road Information Management Steering Group. Parkman, C., *et.al.* Pavement Deterioration Modelling in Long-Term Performance Based Contract: How Far does it Mitigate the Risk for Client and Contractor? Visited 31 January 2006.

period⁴⁵. Customer complaints in the Philippines are acted upon but these are not taken into account in the monthly payment to the contractors.

Monthly reporting on work accomplished is the responsibility of the contractor in New Zealand. The reports are submitted to the road controlling authority for random audit and verification, and then processed for the contractor's monthly payment. In the Philippines, a daily accomplishment report is recorded by the DPWH project inspector. This report is for the internal use of the DPWH to be used to compare the accomplishment with the other procurement methods used. The daily accomplishment report is also used to verify if the performance requirements are fulfilled by the contractor. The performance requirements are further validated by a joint inspection by representatives of the DPWH, the Commission on Audit, and the contractor (Kampsax International A/S 1999). The consultant's completion report showed that the pilot projects had one project engineer, one materials engineer and one project inspector each. As mentioned earlier, the length of the pilot projects ranged from 33 to 111 km. Judging from the circumstances cited, the researcher thinks that the conduct of daily inspections would not be possible for one project inspector. The responsibility may be passed on to the contractor and the daily reports may be regularly or randomly checked by the project inspector. One option would be to assign more project inspectors for a single project to allow for a reasonable length of road inspected daily. Another option would be not to conduct daily inspection but on a regular basis, say, twice a week, so that the project inspector will have time to cover the whole stretch of the project.

As New Zealand is in the advanced stages of implementing performance-based specifications, it can be seen that road controlling authorities have given the contractors full control of the maintenance of the road network. On the other hand, the Philippines had to guide the contractors with the adoption of the new system of performance-based specifications. With the pilot projects, the DPWH had to devise a system to compare method-based specified maintenance contracts and performance-based contracts. The quantities, resources used, and costs were compared using the daily accomplishment report recorded by the DPWH project inspector. The

⁴⁵ Southland District Council. Contract Number 05/02. Part 5. Network Maintenance and Management Contract. North Western Area.

consultant monitored and compared performance-based maintenance activities with the DPWH's quantity estimate, and in all cases, the former far exceeded the latter. The cost-effectiveness of performance-based maintenance as compared to maintenance by contract (MBC) and maintenance by administration (MBA) was also examined. Results in the final assessment report (BCEOM Société Française D'Ingenierie 2005) showed that in all cases, the actual accomplishment of the performance-based maintenance contractors surpassed those of the MBC and MBA, which were method-based.

7.4 Performance Specifications

7.4.1 Sealed Roads

Table 7.2 and Table 7.3 show some examples of the operational performance measures for New Zealand and performance standards used in the PSMC pilot projects in the Philippines, respectively. The operational performance measures show the road features, the performance required and the response time to correct defects. The performance measures for the pilot projects in the Philippines also include the penalties for non-compliance to performance requirements.

Transit New Zealand has adopted comprehensive operational performance measures that cover the total maintenance of the state highways. There are at least 22 operational performance measures for the maintenance of pavements, bridges, shoulders, drainage systems, barriers, lighting, pavement markings, road signs, sight rails, edge marker post, litter removal, and vegetation control. The OPMs also include crash and damage reporting, frost and snow clearance, incident response and work practices. The maintenance specifications⁴⁶ describe clearly the performance requirements and define technical terms used. The performance measures are very specific to the type of road feature and the level of service required. New Zealand roads require a higher level of service to be able to satisfy the demands of the ratepayers. This is one of the reasons why the roads are in better condition and

⁴⁶Transit New Zealand. Maintenance Specification. General Maintenance Project. SM032Transit Contract.

Table 7.2. Some Selected Operational Performance Measures for Transit New Zealand's PSMC Contracts⁴⁷

Feature	Contract Standard	Response Time
Potholes on all highways	No potholes greater than 150 mm diameter	48 hours
Repair surfacing on all highways	Surplus and/or loose chip does not create potential traffic hazard or create public complaints	2 hours
Cracking on moisture sensitive pavements	The total area within any continuous kilometre is less than 10m ²	1 month
Heaves and shoves on M, R1 and R2	There are no heaves and/or shoves greater than 20mm	2 weeks
Depressions and rutting on all highways	There is no ponding greater than 30 mm in depth at any location. This includes existing pavement subsidence sites	6 months
Edge break on all highways	There is not more than 2m of edge break within any continuous kilometre less than 0.5m wide	1 month
Service covers on all highways	All service covers are within \pm 10 mm of the surrounding pavement surface	2 months
Work practices on all highways	All completed work must comply with maintenance specification, clauses 5.16	At all times
Shoulder maintenance on all highways	The maximum length of low shoulder, including edge rutting, is less than 100m in any continuous kilometre section	2 months
Sealed surface detritus on all highways	There is a maximum of 50 grams of detritus per two square metres of sealed surface	1 week
Small slips on all highways	Small slips are removed	2 weeks
Lined channels on all highways	There are no lined channels with more than 10% of the cross-section area obstructed, and lined channels are maintained vegetation free	1 week
Sumps, manholes and catchpits on all highways	There is not more than 30% of the volume of any structure filled with debris	3 months
Culverts on all highways	There is no culvert with more than 10% of the cross-sectional depth of the culvert inlet, outlet or barrel filled with debris	2 weeks
Cleanliness on all bridges	All components are free of moss, vegetation, detritus, etc	6 months
Structural integrity of all bridges	All structural damage is reported to the consultant	48 hours
Structural integrity of all bridges	All structural deterioration is reported to the consultant	6 months
Barrier maintenance on all highways	All damaged barriers are permanently repaired	1 month
Functionality of raised pavement markers	There are not more than 2 dysfunctional raised reflective pavement markers (RRPMs) within any 10 continuous RRPMs	2 weeks
Uniformity of pavement markings	There is not more than 1 location within any continuous 5km where the pavement markings do not comply with the manual of traffic signs and markings	1 month

⁴⁷ Transit New Zealand. Maintenance Specification. General Maintenance Project. SM032Transit Contract.

Table 7.3. Performance Specifications for LTPBMC Pilot Project in the Philippines

Feature	Performance Requirements/Description	Response Time or Maximum Tolerable Degree of Defect	Penalty for non-compliance
General appearance	Road, bridges, structures shall be clean, free of garbage and obstructions and maintained to the required standard	Any given time	P2,000 per km per week of non-compliance
Asphalt pavement			
Potholes	Hole or depression larger than 15 cm x 15 cm and deeper than 5 cm	Within 24 hours	P1,000 per pothole not repaired per day
Pavement damage	A total of 100 m ² of alligator cracking or 400m of cracks or a combination thereof, width of a crack is 25 mm	To be sealed within 10 to 30 working days depending on AADT	P1,000 per pavement damage not sealed within response time and P2,000 for every succeeding month of non repair
Pavement markings	Considered in good condition when it is clearly visible during day and night	60% to 90% of the markings in good condition depending on AADT	P1,000 per km if not remedied within one month and P2,000 per km for every succeeding month of non-compliance
Concrete pavement			
Local damage, depression failed slabs (blocks)	Hole or depression larger than 15 cm x 15 cm, but less than the size of one slab (block) and deeper than 5 cm	Within 24 hours	P1,000 per local damage, depression not repaired per day
Failed slabs (blocks)	Any concrete slab with more than 8 metres of cracks or not in level with adjacent slabs	To be repaired within 10 to 20 working days depending on AADT	P4,000 for every concrete slab not repaired within the response time and P8,000 for every succeeding month of non-repair
Joints/cracks	Joints/cracks are considered sufficiently sealed when filled with sealant to the level of the pavement surface	60% to 90% of the joints/cracks shall be sufficiently sealed depending on AADT	P1,000 for every km with joints/cracks not sealed within one month and P2,000 per km for every succeeding month of non-conformity
Pavement markings	Considered in good condition when it is clearly visible during day and night	60% to 90% of the markings in good condition depending on AADT	P1,000 per km if not remedied within one month and P2,000 per km for every succeeding month of non-compliance

Feature	Performance Requirements/Description	Response Time or Maximum Tolerable Degree of Defect	Penalty for non-compliance
Shoulders/roadside			
Shoulder damage	A total area of 100m ² of potholes and/or depressions deeper than 10cm	To be repaired within 10 to 30 working days depending on AADT	P1,000 for every shoulder damage not repaired within the response time and P2,000 for every succeeding month of non-repair
Sufficient level and cross-slope	The level of the shoulder along the pavement edge is equal to the level of the pavement or is no more than 5 cm lower. The shoulder cross-slope is between 2% to 4% away from the pavement	To be repaired within 10 to 30 working days depending on AADT	P1,000 for every 1 km not remedied within response time and P2,000 per km for every succeeding month of non-remedy
Vegetation	Roadside area within 5 metres from the edge of the pavement	Height of grass and vegetaion shall not exceed 15 cm at any time	P5,000/ km if not remedied within one month and P5,000/km for every month of non-compliance
Drainage			
Side drains, culverts and drainage system	The drainage facility's capacity is reduced by more than 25%	Any disruption of the free flow of surface water shall be remedied within 10 to 30 working days depending on AADT	P500 per location not remedied within the response time and P1,000 per location for every month of non-remedy
Side drains, culverts and drainage system	Minimal accumulation of silt and debris	Siltation and debris shall not exceed 15 cm at any time	P1,000/km if not remedied within one month and P2,000/km for every month of non-compliance
Bridges			
Bridge deck, drainage system, outlets & waterway	Minimal disruption of free flow of water	Any disruption of the free flow of water shall be remedied within 10 to 30 working days depending on AADT	P500 per bridge not remedied within the response time and P1,000 per bridge for every month of non-remedy
Bridge painting and signage	The bridge painting, markings, warning and regulatory signs shall be clear of obstructions, clean and readable	Any given time	P1,000 per brigde if not remedied within one month and P2,000 per bridge for every month of non-compliance

Feature	Performance Requirements/Description	Response Time or Maximum Tolerable Degree of Defect	Penalty for non-compliance
Signage and guardrails			
Signage and guardrails	Road signs and other regulatory or warning devices and guardrails shall be clear of obstructions, clean and readable	Any given time	P100 per sign or device not remedied within one month and P200 per sign for every month of non-compliance. P1,000 for every 100 m of guardrails not remedied within one month and P2,000 for every 100 m for every month of non-compliance

Kampsax International A/S. 1999. Advisory Consulting Services for the Study on the Long Term Performance Based Maintenance Contracts. Annex B. Unpublished Report. Department of Public Works and Highways

with better quality than the Philippines.

The performance specifications for the pilot projects in the Philippines required the total maintenance for the main road features but do not have the details on particular defects. An example is the required specific level of service for rutting and edge break of asphalt pavements. The repair of potholes on asphalt pavements should have some exceptions due to the heavy penalties which are counted per pothole per day. The researcher believes that the repair of potholes would not be practical for the contractor especially during the rainy season. Continuous rains would not permit the correction of defects according to the prescribed standards. The corrections might yield unsatisfactory results which would end up with further deterioration and wasted resources. This is also true for other defects which worsen the road condition, but cannot be remedied immediately within the prescribed time because of circumstances beyond the control of the contractor. Suspensions for the imposed penalties on the contractor must be considered.

The New Zealand performance measures for surface detritus on roads specify a measurable quantity (i.e. maximum of 50 grams/2m² of sealed surface) and

cleanliness of bridges define the requisites (i.e. free of moss, vegetation, and detritus) for the feature. On the other hand, the general appearance of roads and bridges in the Philippines require the structures to be clean and maintained to the required standard. The use of the term 'required standard' is ambiguous and misleading, unless it was defined in the contract documents. The contracting parties might interpret it differently hence, there is a need to clearly describe performance specifications to avoid conflicting ideas during project implementation.

The maintenance of the drainage system is as important as pavement maintenance. The trigger factors for maintenance compliance are 10% and 25% reduced capacity of drainage facility, for New Zealand and the Philippines, respectively. The researcher has observed that the drainage systems along the state highways in New Zealand are smaller in size but more efficient compared to the Philippines. This is due to the high level of service required of the drainage structures. They are expected to function to optimum capacity as most of New Zealand roads are asphalt that needs to be well drained to prevent rapid deterioration.

The OPM for bridges in New Zealand covers the over-all maintenance of bridge components including reporting the structural integrity of bridges to the network consultant. In the Philippines, only the physical bridge condition and waterway was given emphasis. Performance-based specified contracts are usually long-term, thus, there is a need to include the inspection of structural damage and deterioration of bridges so that remedial measures are done immediately.

Road signs are important to inform and guide motorists for safe travel. New Zealand's OPMs for sign maintenance are broad covering all types of road signs (permanent and seasonal), the presence of visible and correctly aligned road signs, inventory of signs, and particular about missing road signs. In the Philippines, only the existing signs are required to be maintained, and there are no provisions for missing signs. Since there had been cases of burglaries of road signs, the performance specifications must assure the presence of the road signs to warn road users.

The performance requirements for the pilot projects in the Philippines are simple compared to the thorough performance measures of New Zealand which have evolved through the years. The researcher believes that lessons learned from the pilot projects, including new trends from New Zealand and other countries will help develop more systematic and detailed performance requirements for the maintenance of Philippine roads.

7.4.2 Unsealed Low-Volume Roads

Unsealed roads include gravel and earth roads that require performance measures that are simple and inexpensive to measure and control (Zietlow 2004). To make them sustainable, it is important that they are maintained with at least a minimum level of service. The road must be clean, accessible, open to traffic and free of obstruction at all times. The comfort of the road user should be considered based on acceptable limits of rutting, corrugations, potholes and surface defects. Performance specifications must ensure road users are safe and can drive safely at the specified average speed. The drainage structures must be in good condition and vegetation must be less than an acceptable height.

Table 7.4 shows the operational performance measures for unsealed low-volume roads from four road controlling authorities in New Zealand. The performance requirements for the maintenance of unsealed roads differ among the RCAs. The differences may be due to the following: 1) the levels of service expected by the ratepayers and customers, 2) the maintenance funds available for the road, 3) the geographical location of the RCA, 4) the social and economic activities in the RCA, and 5) the cultural background of the community.

The RCAs have to consider a level of service that is sustainable. Since most of the unsealed low-volume roads are rural by nature, their primary purpose is for transporting agricultural and forestry products to processing plants or to urban centres. The Local Government New Zealand (LGNZ) has acknowledged the significant benefits of the additional productivity in the rural sector. The wear and tear of rural roads posed by heavy vehicles prompted LGNZ to ask Government to

increase financial assistance for the maintenance of existing roads⁴⁸. The rural road network must be upgraded and maintained to adapt to the changing traffic volume and type of traffic. The maintenance effort has to be balanced with minimised costs, without compromising safety of the road users and comfort for smaller communities.

Table 7.4. Operational Performance Measures for New Zealand Unsealed Low-volume Roads.

Feature	Contract Standard	Response Time
Potholes	There are no potholes greater than 200mm diameter and depth less than 35mm ^{ab} Less than 25mm depth ^c There are no potholes greater than 400mm diameter and depth less than 35mm ^d	Maximum level of service shall not be exceeded at any time
Corrugations	There shall be no corrugations exceeding 20mm from crest to trough ^{ab} Less than 10mm height over any 500m section ^c There shall be no corrugations exceeding 25mm from crest to trough ^d	Maximum level of service shall not be exceeded at any time
Rutting	There shall be no rutting exceeding 50mm ^{abd} Less than 10mm over any 50m section per 500m for local roads and less than 20mm for local access roads ^c	Maximum level of service shall not be exceeded at any time
Surface scouring	No surface scouring for local roads, less than 25mm deep for local access roads ^c	Maximum level of service shall not be exceeded at any time
Loose metal	Less than 15mm deep over any 50m section per 500m, no loose aggregate shall be greater than 40mm in diameter ^c	Maximum level of service shall not be exceeded at any time

a – Ruapehu District Council

b – South Taranaki District Council

c – Central Otago District Council

d – Dunedin City Council

The researcher could not present examples of performance-based specifications for unsealed low-volume roads in the Philippines as the LTPBMC pilot projects were implemented on paved and highly trafficked national roads.

⁴⁸ <http://www.localgovtnz.co.nz/news/pr1088138752.html>. Local Government New Zealand. Barker, M. Provincial and Rural Roads Left Behind. Visited 8 July 2004.



A comparison of performance-based specifications in New Zealand and the Philippines was presented. The specifications in the Philippines were customised to define the performance required of the road network within a period of time, and the penalties imposed on the contractors. The general performance-based specifications for unsealed low-volume roads in New Zealand were also discussed.

7.5 References:

BCEOM Société Française D'Ingenierie. (2005). "Completion Report for Consulting Services for the implementation of of the Long-term Performance-Based Maintenance Project." Manila.

Hardy, P. "Austroads Review of Performance Contracts: The Potential Benefits of Performance Contracts." *Contracting the Future NZIHT Symposium*, 28.

Kampsax International A/S. (1999). "Advisory Consulting Services for the Study on the Long-term Performance-Based Maintenance Contracts." Manila.

Zietlow, G. (2004). "Implementing Performance-Based Road Management and Maintenance Contracts in Developing Countries-An Instrument of German Technical Cooperation." The document can be retrieved from <http://www.zietlow.com>.

8 CONCLUSION

8.1 Accelerators and Impeding Factors using Performance-Based Specifications

New Zealand road authorities have been accumulating experience and gaining benefits with performance-based specifications since 1998, while the Philippines is still in the initial stages of adoption. Performance-based specifications have been successfully implemented on New Zealand state highways and have gained recognition with local road controlling authorities. From the survey conducted, about 80% of RCAs have moved from method-based specifications to adopting performance-based specifications.

The New Zealand Local Government Act of 1974 and 2002 empowered local councils to build, upgrade and maintain local roads, as they see fit depending on Central Government requirements and consistent with the community's desire for high quality infrastructure services. The LGA 2002 required local councils to have a 10-year Long-Term Council Community Plans (LTCCP) where the desired community outcomes and expected levels of service of the road network are identified. The management of the road network is also embodied in the Land Transport Management Act 2002 and the New Zealand Land Transport Strategy, aiming to achieve an integrated, safe, responsive, and sustainable transport system.

Improving road maintenance management in the Philippines, based on a study of RCAs in New Zealand, was the goal of this research with the theme of managing the change from method-based specifications to performance-based specifications. The profile of RCAs that are more likely to adopt performance-based specifications was established. Generally, the RCAs that have adopted performance-based specifications have the following characteristics:

1. Employ asset managers to be in charge of the overall maintenance of the roading network;
2. Outsource consultants providing specialist skills;
3. Use maintenance management tools like RAMM;
4. Conduct customer surveys to know ratepayers' opinions, thus, validating the effectiveness and efficiency of the maintenance of the network;
5. Have written and modified their own maintenance specifications;
6. Have more resources in terms of rates and revenue per road kilometre;
7. Have more annual maintenance expenditure per road kilometre;
8. Have a higher percentage of rural roads;
9. Have less road length per engineer;
10. Evaluate contractor's accomplishments on the basis of performance required of the road network by using a marking and scoring system.

The Philippines is moving forward and is improving road maintenance to be in line with the trend in progressive road authorities around the world. The initial reforms implemented by the DPWH were effective tools that facilitated the management of change. The contributing factors learned from this study will guide road authorities in the Philippines to improve the implementation of future LTPBMC projects on national roads, and possibly to apply the same to low-volume roads. To gain success with managing change, the government must support the program and be open-minded to the transformation to the new system.

DPWH engineers have the skills and expertise on road maintenance but need to be guided more on asset management to prepare for the adoption of performance-based specifications on a wider scope. The DPWH has been training engineers nationwide to gain skills and expertise on the reforms introduced through the RIMSS project. For the LTPBMC pilot projects, training was limited to engineers directly involved with the projects (i.e. project engineer, materials engineer and project inspector). During the implementation of the pilot projects, there were issues with the turn-over of employees; trained engineers left the DPWH for better opportunities abroad or other private companies. The government should have measures to mitigate the risk of losing skilled engineers. Engineers in the DPWH should have training courses on topics such as asset management, contract management, and developing performance

specifications. Training courses should also be extended to local consultants and local contractors to strengthen the local industry.

Modern analytical tools for asset management have been in operation and continuously developing in the Philippines through the reforms introduced in the RIMSS project. The Road and Bridge Information Application (RBIA), the warehouse for traffic and road condition data, is in place. The data in RBIA are used for the pavement management system (PMS), which provides needs analyses, multi-year programming and budgeting. The DPWH must ensure the integrity and sustainability of the data as it will be the basis of forward planning works.

Involving ratepayers in the maintenance management of the road network is essential to obtain feedback. The DPWH has to strengthen the functions of the Complaints and Action Center (CAAC) to give meaning to the data they are receiving. They should be encouraged to conduct and analyse customer surveys to determine the effectiveness and efficiency of the maintenance management systems. Through the customer surveys, the ratepayers and other stakeholders (i.e. politicians) will be well informed and educated on the implementation of the systems in place, at the same time encouraged them to be involved in proactive and reactive maintenance.

To gain success in managing the change, the government must assure the availability of sufficient funds to make the road network sustainable for future generations. This is possible through the foreign grants or loans and the prudent management of maintenance funds by the Philippine Road Board. As mentioned in Chapter 5, a review of the percentage allocation for national roads and local roads is needed to cope with the increasing demands of the local road network.

Developing suitable, adaptable, and measurable performance-based specifications is an important aspect to adopting the new system. The performance specifications should be clear, precise and leave no ambiguities to prevent conflicts in project implementation. The performance requirements should encompass all the elements of all road and roadside structures and should be modified or reviewed for revision from time to time to cope with the changing traffic patterns and road conditions.

The contractor must be motivated to perform well and sustain a long-term contract. The Philippines impose tough penalties for non-compliance but can also adopt New Zealand's provision of incentives to contractors for good performance and productivity improvement.

8.2 Proposals for Performance-Based Specifications

Performance specifications need to guarantee the quality and durability of the end product. The comfort and safety of the road users are important factors to consider when developing performance specifications. The criteria for performance specifications which define the outcomes include roughness, surface texture, skid resistance, rutting, and pavement strength for sealed roads. Unsealed roads require lower levels of service in terms of roughness, rutting, corrugations, potholes, surface defects, and a maximum level of dust. The acceptable limits differ based on local road conditions, geography, climate, economic and social activities, and community requirements. To make unsealed roads sustainable, it is important they are maintained to a minimum by keeping them clean, accessible, free from obstructions, and with functioning drainage and well-maintained roadside structures.

.....

The DPWH has adopted performance-based specifications and progress was well on its way. This research hopes to help in the process of maintaining sustainable roads for future generations.

Appendix 1

Survey Questionnaire

Dear Respondent,

This material has been prepared as an instrument to guide the researcher in determining the best practices in the maintenance management of unsealed low-volume roads in New Zealand. Be assured that all information gathered will be kept confidential.

Thank you for spending valuable time to answer the questions and contributing to this project. All respondents will be provided with a survey summary upon completion of the analysis of results.

Yours truly,

Romelda A. Bangasan

Researcher

Email: rab131@student.canterbury.ac.nz

Road Controlling Authority _____

1. Please furnish a copy of the organisational chart of your Road Controlling Authority.

2. Which position oversees the maintenance of unsealed roads in the District/City?

3. Describe in 1 or 2 lines, the duties of the positions related to the maintenance of roads.

4. What is the title/name of the specifications document used in the maintenance of unsealed roads?

5. How were the specifications developed?

6. By what processes were the specifications developed?

7. On what basis are revisions (of specifications) made?

8. How frequent are revisions (of specifications) made?

9. What is the protocol for handling customer complaints?

10. Do you survey and analyse customer complaints? If so, what is the frequency of analysis?

11. What typical maintenance activities are performed on unsealed roads? What is the frequency and what triggers (initiates) these activities?

Maintenance Activity	Yes/No	How frequently?	What triggers the activity?
Light Grading			
Heavy Grading			
Gravel Resurfacing			
Additional Metal			
Restoring Drainage System			
Ditch/Culvert Cleaning			
Vegetation Control			
Dust Control			
Reshaping of Shoulders			
Restoration of Signs			
Guardrail Maintenance			
Restoration of Roadside Furniture			
Others (Specify)			

12. How do you evaluate the acceptability of a contractor's work?
