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**PERFORMANCE-BASED ROAD MANAGEMENT AND MAINTENANCE
CONTRACTS
- WORLDWIDE EXPERIENCES -**

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Abstract

Cutting the cost of road maintenance and improving road conditions are the main reasons why several countries around the world have started to look for new ways of contracting out road maintenance in the 1990s. Presently, more than 80000 kilometers of roads are being managed and maintained under Performance-Based Road Management and Maintenance Contracts (PBC) worldwide.

The traditional way of contracting out road maintenance is based on the amount of work being measured and paid for on agreed rates for different work items. By contrast, PBC define minimum conditions of road, bridge, and traffic assets that have to be met by the contractor, as well as other services such as the collection and management of asset inventory data, call-out and attendance to emergencies, and response to public requests, complaints and feedback. Payments are based on how well the contractor manages to comply with the performance standards defined in the contract, and not on the amount of works and services executed. PBC define a final product and it is up to the contractor how to achieve this. Therefore, work planning, execution, and control are all his responsibility. Hence, the choice and application of technology and the pursuit of innovative materials, processes, and management procedures are all up to the contractor. This allocates higher risk to the contractor compared to traditional contract arrangements, but at the same time opens up opportunities to increase his margins where improved efficiencies and effectiveness of design, process, technology or management are able to reduce the cost of achieving the specified performance standards.

This paper provides a brief the history of PBC, describes the main reasons for implementing such contracts, presents the spectrum of performance indicators and response times being applied, discusses the preparation of bidding documents and the bidding process, gives special attention to the performance indicators and response times and performance monitoring and payment procedures, summarizes how these contracts have been implemented, and provides lessons learned so far.

1. Brief History of Performance Contracts

The development of PBC for road maintenance started in the late 1980's and early 1990's. First British Columbia in Canada contracted out its road maintenance in 1988. But performance standards were still more oriented towards work procedures and materials to be used, rather than result oriented, very much limiting the contractor in the application of new technologies.

Shortly afterwards, Argentina concessioned approximately 10000 kilometres of its national roads, using end result performance specifications for the maintenance services and a penalty system for not meeting response times for rectifying deficiencies. In the mid 1990 the maintenance of another 10000 kilometres was contracted out using similar performance specifications. But this time without applying tolls, since average traffic levels were below 2500 vehicles per day and therefore could not sustain a tolling system. These contracts are also referred to as CREMA, contracts for rehabilitation and maintenance.

In the mid 1990's Uruguay started its first pilot scheme of PBC on a small network of 359 kilometres of its national roads. In the same year Montevideo followed suit by contracting out the maintenance of 150 kilometres of its main arterial urban roads. The new contracting scheme proved to be so successful that only five years later 50% of the national roads in Uruguay were being maintained through PBC.

Box 1: Uruguay was quick to adopt Performance-Based Road Asset Management and Maintenance Contracts

National road network

In 1996 the Ministry of Public Works started a program to introduce performance-based contracts for the maintenance of the national road network of Uruguay. Basically, there were two types of contracts; one covered routine maintenance only and the other one included initial rehabilitation and periodic and routine maintenance.

The first type of contract was developed to give employees of the Ministry of Public Works an opportunity to form their own private enterprises and to reduce the Ministry's staff at the same time. To provide additional incentive the staff was given the opportunity to return to the ministry during the first year of the contract in case the system failed. None of the contracts failed and more people wanted to join the new systems than new contracts could absorb.

The second type was introduced as a pilot project and rapidly went beyond this stage as the systems was producing excellent results in a fairly short time-period. By January 2000 42% of the national road network was being maintained by performance based road maintenance contracts. Key to the success was careful planning and implementation of contracts. Due to legal restrictions contract duration is limited to 5 years.

City of Montevideo

Montevideo started the first performance based contract for 138km of its city roads in 1996 as well. Due to deficiencies parts of the road network required initial spot rehabilitation, which was paid for on a unit price basis. The 3-year contract allows for a 3-year extension, whereby the monthly fixed payments will be reduced by 40% during this extension period.

Performance standards, response times and penalties for non-compliance are defined for Pavements, Shoulders, and Drainage systems.

Since actual road conditions were substantially below the performance standards defined in the contract, the contractor was given between 3 and 12 months to upgrade the different assets to the required standards.

Several other countries in Latin America such as Brazil, Chile, and Colombia Ecuador, Guatemala, and Peru have started similar contracts. Most of these contracts include partial rehabilitation to bring roads to maintainable conditions. Today more than 50000 kilometres of roads in Latin America are being maintained under PBC.

Australia started its first Performance Contract in 1995 covering 459 kilometres of urban roads in Sydney [Frost, M. and C.Lithgow. 1996]. Since then several new contracts have been implemented in New South Wales, Tasmania, and Southern and Western Australia. Some of them as so called hybrid contracts, where some of the works are being paid based on quantities and unit prices and others based on performance criteria.

In 1998 New Zealand let its first Performance Contract for the maintenance of 406 kilometres of national roads. Presently, more than 15% of New Zealand's national roads are maintained using the new contract scheme.

In the United States of America, the State of Virginia pioneered a Performance Contract called "Asset Management and Maintenance Contract" for the maintenance of 402 kilometres of Interstate Highways in 1996. Four years later Washington D.C. followed suit with a similar contract that covers 119 kilometres of federal roads [Federal Highway Administration. 1999]. By now, several other states have contracted out maintenance on parts of their road networks using PBC, with some of them applying a mixture of performance specifications and unit prices.

Since 2000 PBC have virtually mushroomed and spread to Europe, Asia, and Africa. The World Bank, the Inter American Development Bank, the Asian Development Bank as well as ERBD are actively promoting the new contracting scheme.

2. Main Reasons for Implementing PBC

The main reasons for contracting out road maintenance implementing PBC are to

- reduce maintenance costs through the application of more effective and efficient technologies and work procedures;
- provide transparency for road users, road administrations and contractors with regard to the conditions roads have to be maintained;
- improve control and enforcement of quality standards; and
- improve overall road conditions and road user satisfaction.

The introduction of PBC in road maintenance has resulted in considerable cost reductions in Australia, the United States and New Zealand (see section 6). In Latin America no cost reductions have been reported so far, since no cost comparison studies have been undertaken. But road conditions have notably improved on roads that are being maintained under the new contracting scheme.

3. Preparation of Bidding Documents and Bidding Process

All countries, which have introduced PBC, have done so gradually, starting with one or two pilot projects in order to gain experiences with the new contract arrangement.

Before embarking on such pilot scheme, it is necessary to analyze its legal and financial feasibility first. One of the most important legal aspects is the maximum contract period allowed by law. In most of the countries in Latin America, for example, the maximum contract duration is restricted to either four or five years, making it necessary to change laws in order to accommodate long-term contracts. Financing has to be secured for the entire duration of the contract. For example, one pilot project in Brazil had to be abandoned only after one year of operation due to a shortage of funds.

Prior to the preparation of the bidding documents a number of steps have to be taken to define the road network to be contracted out, to make an inventory of the assets involved and to determine its condition, to select and define the performance indicators, select and define the methods of measuring those indicators, to define the likely maintenance and possibly rehabilitation works, and to prepare preliminary cost estimates. The data on the inventory and the conditions of the assets are given to the potential contractor as reference only. It is the responsibility of the contractor to make sure that the information is correct, since he has to assume responsibility for meeting the performance criteria. A methodology of designing a pilot contract can be retrieved under <http://www.zietlow.com/docs/actcns.pdf>

For the preparation of bidding documents, existing bidding documents used for road construction can be used, but they will have to be adapted to suit the special nature of PBC. PBC that are being used in other countries might be helpful. A Sample Bidding Document “Procurement of Works and Services under Output- and Performance-based Road Contracts and Sample Specifications”, prepared by the World Bank can be found under <http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/PROCUREMENT/0,,contentMDK:20646773~menuPK:84284~pagePK:84269~piPK:60001558~theSitePK:84266,00.html>.

Another valuable source for bidding documents and performance indicators/levels is the website of Transit New Zealand, see for example http://www.transit.govt.nz/technical/view_manual.jsp?content_type=manual&=edit&primary_key=48&action=edit

Since PBC are new for road administrations and contractors alike, close cooperation between both parties is vital for success. Both sides have to be comfortable with the contractual arrangement and understand the risks involved. In all PBC that have been let until now, road administrations and contractors have closely worked together in preparing the bidding documents.

In some countries such as Uruguay the road administrations, which were used to prepare bidding documents without consulting contractors, had to adjust to the new situation and consult contractors, because of a lack of interest to embark on the new contracting scheme by contractors. In the United States it was the contractor who actually initiated the process and presented a draft of the bidding documents to the road administration. In this case the Virginia State Parliament had to pass a law first to allow for unsolicited bids to be accepted by the Virginia Department of Transport.

In almost all the other PBC competitive bidding procedures have been used after pre-qualification of potential contractors. Especially in the case of pilot schemes the qualification of

the contractor is a major factor besides the overall price. Therefore, the contractor who offers the lowest price does not necessarily wins the contract.

PBC essentially are fixed price contracts. But they often do contain a schedule of prices for emergency works. If sections of the road in question are in poor condition, the contract should include the rehabilitation of these sections as well. In this case rehabilitation works may be carried out in the "traditional" form, with official design and paid on the basis of unit prices as in the cases of Chile, Colombia and Uruguay. Or alternatively, final design of rehabilitation works can be left to the contractor and payment for these works can be included in the lump sum contract price. Argentina has taken this approach whereby 55% of the lump sum has been paid in three instalments during the first year (rehabilitation period) and 45% in 48 equal monthly instalments in the years two to five of the five-year contract period. To include initial rehabilitation works in the PBC has two main advantages: first, it gives the contractor incentives to perform well on the rehabilitation works to avoid premature repairs which would increase maintenance cost, and second, it insures that maintenance will start immediately after the rehabilitation works have been finished.

PBC shift much of the risk to the contractor, which is normally assumed by the road administration. Therefore, the potential bidders have to be given sufficient time to prepare their bids. This time of course is much longer than in the case of "traditional" maintenance contracts.

PBC are essentially management contracts and traditional road construction or maintenance contractors often do not have the required qualifications necessary for this type of contract. Consulting firms with extensive know-how in managing other contractors and experiences in pavement management systems seem to be more suited for the job. In Virginia, for example, the PBC is managed by a firm, which has been formed by two consulting firms. Most of the maintenance works are subcontracted, allowing for an efficient resource allocation (just on time principle). A joint venture of a road construction firm and a consultant might also work well. The evaluation criteria and weights that have been applied to award the PBC in Washington D.C. are compiled in Figure 1.

Technical	Experience, knowledge and understanding of issues relating to preservation and maintenance of the assets covered by this contract. Soundness of technical approach for meeting the performance measures for all of the assets referenced in this contract	20%
Staffing, Quality Control/Quality Assurance, Management	Staffing Plan	5%
	Management Plan	5%
	Quality Control/Quality Assurance Plan	5%
Past Performance	The extent to which the Prime Contractor's and subcontractors' past performance on similar asset preservation, maintenance, and management contracts demonstrates a likelihood of successfully performing all of the tasks set forth in this contract.	15%
Cost	The extent to which proposed costs are realistic and reflect the likely overall cost to the government over the term of the contract	50%

Figure 1: Evaluation Criteria and Weights Applied for the Award of the Performance Contract of Washington D.C.

4. Performance Indicators and Response Times

To define the “right“ performance indicators is a rather challenging task. The objective is to satisfy a set of goals such as

- to minimize total systems cost, including the long-term cost of preserving road, bridge and traffic assets and the cost to the road user, and
- to satisfy comfort and safety of road users.

To avoid ambiguity, performance indicators have to be clearly defined and objectively measurable. Typical performance indicators are:

- The International Roughness Index (IRI) to measure the roughness of the road surface, which affects vehicle operating cost;
- The absence of potholes and the control of cracks and rutting, which effects safety and pavement performance;
- The minimum amount of friction between tires and the road surface for safety reasons;
- The maximum amount of siltation or other obstruction of the drainage system to avoid destruction of the road structure; and
- The retro reflexivity of road signs and markings for safety purposes.

As traffic conditions vary from road section to road section, different sets of parameters will create minimal system cost, taking into account road maintenance and vehicle operating costs. The application of the Highway Design Model (HDM) can be helpful to define some of these parameters, such as the IRI.

Examples of performance standards applied in different contracts in Latin America are compiled in Figure 2. For more details see <http://www.zietlow.com/docs/spadocs.htm> and go to Contratos de Conservación Vial por Estándares ó Niveles de Servicio.

Asset Class	Component	Performance Indicator
Pavement	Potholes Roughness (asphalt) Roughness (bituminous treatment) Rutting Cracks	No potholes IRI < 2.0 (Argentina), IRI < 2.8 (Uruguay) IRI < 2.9 (Argentina), IRI < 3.4 (Uruguay) < 12mm (Argentina), < 10mm (Uruguay, Chile) Sealed
Gravel surfaces	Potholes Roughness Thickness of gravel layer	No potholes IRI < 6 (Uruguay), IRI < 11 (Chile) 10 cm (Chile, Uruguay)
Shoulders	Potholes Cracks Joints with pavement	No potholes Sealed Vertical alignment < 1cm (Chile, Uruguay), sealed (Peru)
Drainage system	Obstructions Structures	No obstructions. Should allow for free flow of water (Chile, Uruguay) Without damages and deformations (Chile, Peru)
Road signs and markings	Road signs	Complete and clean (Argentina, Chile, Peru)

	Road markings	Complete and visible (Argentina, Chile, Peru)
	Reflectivity of road markings	160 mcd/lx/sqm. (Argentina) 70 mcd/lx/sqm. (Uruguay)
Right of way	Vegetation Foreign elements	< 15cm height (Argentina, Uruguay) No foreign elements allowed

Figure 2.: Examples of Performance Indicators Applied in Different PBC in Latin America

While in the PBC in Latin America all performance indicators have to be met 100%, the contracts in Australia, New Zealand, and the United States allow performance targets to be less than 100%, see Figure 3. For a list of performance indicators used in the contract in the State of Virginia go to <http://www.zietlow.com/docs/washdcap.pdf> and for a list of performance indicators and response times used in New Zealand go to http://www.transit.govt.nz/technical_information/content_files/Amendment68_PDFFile.PDF

Asset	Outcome	Performance Target in % of Asset	Performance Standards
Cross Pipes < 36 ft sq)	Structurally sound Open drains Joints intact Adequate capacity No erosion	95	< 10% deteriorated barrel > 90% diameter open Joints intact End protection intact No dip in road over pipe indicating structural problems
Paved Ditches	Aligned Structurally sound Clean	95	< 1" settlement < 25% spalled no obstruction to flow of water
Sidewalks and Ramps	Smooth Safe Sound	90	No settlement > 1/2" No unsealed cracks > 1/4" < 25% spalled

Figure 3. Example of Performance Indicators of the Performance Contract let in Virginia, USA

For each performance indicator there is a response time and often a penalty defined for non-compliance. For example, in the CREMA contracts for each pothole more than 2 cm deep, a penalty of US\$ 100 is being applied for each day it stays open. For a detailed list of performance indicators and response times of the CREMA contract see http://www.worldbank.org/html/fpd/transport/roads/c&m_docs/7thiclv.pdf. Another good example for performance indicators and response times is the latest State Highway Professional Services Contract Proforma Manual of Transit New Zealand. The document can be downloaded from the website of Transit New Zealand http://www.transit.govt.nz/technical/view_manual.jsp?content_type=manual&=edit&primary_key=48&action=edit

Feature	Contract Standard	Response Time
Potholes on highways with > 10000 vpd	Not more than 3 potholes with a diameter greater than 70mm on any 10km section	48 hours
Potholes on all highways	No potholes greater than 150mm in diameter	48 hours
Depressions and Rutting	No ponding greater than 30mm in depth at any location	6 months
Edge Break	No more than 2m of edge break within any continuous kilometre greater than 0.5m	1 month
Lined Channels	No lined channels with more than 10% of the cross-sectional area obstructed, and free of vegetation	1 week

Figure 4. Example of Contract Standards and response times used in the State Highway Professional Services Contract Proforma Manual of Transit New Zealand

In addition to the performance indicators defining asset conditions, there are other indicators covering, for example, emergency response times and reporting procedures.

Performance indicators and response times vary widely from one contract to another. Each country seems to follow a slightly different path due to a variety of factors. One thing is clear that performance indicators are still evolving and continue to be a subject of further analysis and debate.

5. Performance Monitoring and Payment Procedures

Performance monitoring is key to the success of this new way of contracting road maintenance. Appropriate control procedures as well as penalties for non-compliance have to be well defined in the contract documents. Procedures defined in various contracts, as well as experiences, vary.

In the case of road concessions in Argentina inspectors are inspecting the road and making random checks to verify compliance at least twice per month. Over time, inspectors become more experienced and familiar with trouble spots along the roads. Experience underlines the importance of having a well-documented inventory of the road as well as daily records of activities undertaken by the contractor. This helps to understand the specific behaviour of the roads and contributes to better preventive maintenance. Inspectors and personnel of the contractors went through a valuable phase of learning and adaptation to arrive at an effective control system. In Argentina a very important role is given to the active participation and control of the road user. Each toll station is keeping a complaints and suggestions book and users are encouraged to report incidents to the Road Administration. Extensive use of this mechanism has helped to improve road conditions and has revealed an increasing satisfaction of the road users with the new scheme. As for the CREAMA contracts performance monitoring and payment procedures are very similar to the ones in Chile.

In Uruguay there are four kinds of inspections: (i) monthly inspections cover 10% of the roads under contract. Selection of stretches of 1 km each is based on a random sample well defined in the contract; (ii) weekly inspections looking at 5% of the roads randomly selected; (iii) non-programmed inspections to respond to complaints by road users; and (iv) follow-up inspections to verify that appropriate action has been undertaken by the contractor to rectify non compliance. Payments to the contractor are based on the results of the monthly inspections. A percentage of compliance is being calculated based on a formula using the results of each individual performance standard as input data. Full payment will only be made on 100% compliance. During the first two years of the contract, compliance has been around 95%. Penalties are being applied if the contractor does not rectify established deficiencies within a certain time limit.

In order to enable the contractor to manage the contract properly and the road administration to monitor, it is vital that the contractor has a proper management and quality control system in place. The Argentinean, Chilean and Uruguayan contracts are especially specific in this respect. Part of the obligations of the contractor is to keep records of his inspections, quality control procedures and works undertaken. This is especially important to monitor and to make necessary adjust to the pilot projects as well as to gain experiences for further contracts. For example, due to the excellent contract monitoring system in place in Uruguay, the recently let contracts show significant improvements over the earlier contracts.

In Australia, New Zealand, and the United States the management and quality control systems used by the contractors are even more sophisticated compared with the PBC in Latin American. The maintenance management system that is being used in the contracts in Virginia covers:

- Asset inventory and condition assessment (updated annually)
- Pavement management program
- Bridge management program
- Snow and ice control operations plan
- Safety management and traffic control plan
- Emergency response plan
- Hazardous materials communications plan
- Customer response plan
- Public information plan
- Implementation plan
- Annual work plan updated every 3 months
- Extensive reporting procedures

The monitoring of the performance of the contractors is done on a daily, monthly, and annual basis. For more details on how this is being done in the case of the contract in Washington D.C., see <http://www.zietlow.com/docs/washdcap.pdf>

Box 2: State of Virginia is the first to let a Performance-Based Road Asset Management and Maintenance Contract in the United States of America

In December 1996 the Virginia Department of Transportation (VDOT) awarded VMS, Inc. (VMS) a contract for asset management and maintenance of 1,250 lane miles or approximately 250 miles of interstate highways. The contract was developed on the basis of performance criteria with clearly defined outcomes. This contract is the first road asset management and performance based contract in the United States of America and an

innovative approach to provide a high and well-defined quality of service to the user at lower cost. Interestingly, VMS is an independent company with two consulting firms as prime investors that made an unsolicited offer to VDOT for this contract, sensing that this line of business is especially apt for consulting firms and is going to have a great future in the US.

Cost Savings

VDOT estimated to save with this contract approximately 16% over the five and one-half year contract period maintaining the highway in its existing conditions.

A report issued by VDOT in December 2000 showed that actual conditions indicate significant improvements resulting in further savings. In addition, VMS has implemented a number of pavement material innovations, including Roadflex, Novachip, and a crack seal program that has improved the service life of the interstate highways.

With a “just-in-time” delivery of maintenance services the contractor engages resources – labour, materials and equipment – on an as needed basis. This lowers total cost by avoiding excess inventory and under utilization of resources.

Asset Management Services

Under the contract VMS is responsible for managing and maintaining the following features to pre-established outcomes:

- Pavement
- Roadside Assets
- Drainage System
- Bridges
- Vegetation & Aesthetics
- Traffic Services
- Emergency Response Services
- Snow and Ice Control

Within each feature there is a series of functional activities. For example, the pavement group includes activities such as pothole patching, base repair, pressure grouting and asphalt resurfacing. Each asset has been assigned a tolerance level of acceptance, which VMS is expected to meet or exceed. For example, potholes are not acceptable if bigger than 75mm x 100mm (3” x 4”) and more than 25mm (1”) deep. VMS guarantees services to meet agreed upon standards and performance measures and backs this guarantee with performance bonds. These outcomes were developed jointly between VDOT and VMS during contract negotiations and provide measurable standards that are monitored on a quarterly basis.

Under the contract VMS is also responsible for traffic control and assistance to the Virginia State Police and to local police and fire authorities. VMS’ response time is 20 minutes during normal working hours and 40 minutes during non-working hours. After major incidents a critique of how well VMS responds and manages traffic control is performed. In addition, VDOT submits questionnaires to all nine Virginia State Police units along the interstate corridors managed by VMS. Past results have indicated that VMS’ performance was highly appreciated.

Subcontractors

In-house staff is providing only approximately 15% of VMS’ services. The remaining services are being subcontracted. In order to raise the quality of services of subcontractors and improve competition among them, VMS engaged in an extensive training program for small contractors. This way better quality could be provided at lower cost. [Lande 1999 and VDOT 2000]

Contractors are being paid a fixed fee per monthly as stipulated in the contract. There are no provisions for deductions to be made to the monthly fee in case of underperformance. Instead, the road administrations have the right to terminate the contracts prematurely if the contractor does not meet his contractual obligations. Especially strict in this sense is the contract in New Zealand (see <http://www.zietlow.com/docs/PSCM-NZ.htm>).

Normally, the fixed monthly fees are adjusted in accordance with a pre-established formula to account for any possible inflation or deflation of prices. The adjustment formula used in the Performance Contract in New Zealand can be found under <http://www.zietlow.com/docs/PSCM-NZ.htm>).

6. Implementation Experiences

The approach taken to implement PBC varies from country to country. The experiences of the road administrations with contracting out road maintenance and the competence of local contractors played a major role. In Latin America for example, the longer the experience of contracting out road maintenance, the more comprehensive was the scheme that has been adopted. Guatemala and Honduras, which previously had executed all road maintenance by in-house staff started with one or two-year contracts with performance indicators related to routine maintenance only.

Brazil, Chile, and Uruguay have started with pilot contracts with a road network of approximately 300 kilometres each, concentrating mainly on roads with asphalt concrete and bituminous treated surfaces. In some cases gravel roads were included as well. Typical contract duration was between 3 to 5 years. Figure 5. provides an overview of PBC in Latin America.

	Number of Contracts	Km (total)	km (average)	Contract Period years	Type of Maintenance	Annual Cost in US\$ per km
Argentina 1 (c)	59	11 295	191	5	I-r	11 000 (a)
Argentina 2 (c)	11	3 623	329	4	r	2 100 (b)
Brazil 1 (c)	7	2 000	286	5	I-r	7 000 (a)
Brazil 2 (c)	1	193	193	3	I-r	1 600
Chile (c)	2	747	374	5	I-r	3 200
Colombia (m)	280	11 487	41	1	r	1 500
Colombia (mU)	5	308	62	1*	r	1 050 (b)
Guatemala (m)	130	4 200	32	1*	r (d)	1 700 (d)
Honduras (m)	36	1 670	46	1	r	1 200 (d)
Nicaragua (m)	27	1 250	46	1	r	1 000 (d)
Uruguay (c)	7	1 486	248	4-5	r-p	7 000
Uruguay (m)	10	1 823	182	2*	r	3 800

Uruguay (s)	2	733	367	2*-4	r	--
Uruguay (U)	1	143	143	3*	r-p	2/m2
Total	579	40 988	(c): 203 (m): 42			

I: initial rehabilitation; r: routine maintenance; p: periodic maintenance
(c): traditional contractors; (m):small-scale enterprises; in Colombia (mU) and in Guatemala with the participation of women;
(U): urban roads; *: renewable for a further term
(a): includes initial rehabilitation cost
(b): small-scale enterprise, the Municipality of Popayán is providing materials and tools.
(d): covers only the drainage system and right of way
Note: Brazil has let performance-based contracts on more than 25000 km during the year 2002

Figure 5. PBC in Latin America (December 2001)

Industrialized countries like Australia, New Zealand or the United States of America started with pilot contracts as well. Normally, duration of the contracts was between 5 to 10 years. Some of these contracts, especially in Australia, were of hybrid nature in order to gain more experiences before going to full fledged PBC. Most of the experiences with the new contract scheme have been very positive and all countries that have started pilot projects have expanded the scheme to cover more and more of their road networks. One of the most important reasons to switch to PBC was the cost saving with regard to traditional contracts.

Cost savings of between 10% and 40% have been achieved by introducing PBC compared to the traditional form of contracting out road maintenance. The contract in Sydney was more than 10%, the contract in Virginia at least 16%, and the first contract in New Zealand 15% and the second 20% lower compared to traditional contract prices. These cost savings have been achieved mainly through better resource allocation, the introduction of new technologies and work procedures, and the training of subcontractors. At the same time contractors are maintaining the road, bridge, and traffic assets to a higher standard than previously applied to the same assets. Since the application of PBC is still at an early stage and road administrations as well as contractors have to gain more experiences with this new kind of contract, it can be expected that costs will drop even further.

Country	Cost Savings
Norway	About 20-40%
Sweden	About 30%
Finland	About 30-35%
Holland	About 30-40%
Estonia	20-40%
England	10% minimum
Australia	10-40%
New Zealand	About 20-30%
USA	10-15%
Canada	About 10-20%

Figure 6. Cost savings of different countries of PBC over conventional contracts road maintenance contracts. Source: Pakkala 2005

7. Lessons Learned and Recommendations for Future Contracts

Most of the PBC have been let recently and are still in a pilot stage. Therefore, only preliminary conclusions can be drawn at this moment. The following recommendations are mainly based on the experiences gained with the PBC in Latin America.

Securing finance on a multi-annual basis is critical to success. Normally, PBC have duration between 4 and 10 years. It is important to secure financing for the entire contract period before starting such a contract.

Each PBC has to be tailored to each specific situation. PBC are still in an early stage of development and differ widely from country to country and even within countries. Studying the experiences of existing PBC in several countries is recommended before embarking on this new type of contract.

Pilot schemes for contracting out road maintenance based on performance indicators should be carefully planned and implemented. The complexity of the contracts, especially with regard to performance indicators, road surfaces and contract duration should be based on past experience in contracting out road maintenance, the ability of the road administration to prepare and monitor such contracts, and the qualifications of local contractors to manage this new type road maintenance contract. Wherever there is little experience with contracting out road maintenance, a gradual approach is recommended, starting with short-term contracts and simple performance indicators with regard to the control of potholes and cracks and the cleaning of the drainage system. Whenever roads are not in maintainable conditions, prior rehabilitation is necessary, either based on unit prices or included in the fixed monthly payments the contractor receives over the contract period.

Whenever circumstances permit, PBC should be longer than five years and should include periodic maintenance in order to maximize the potential benefits. The longer the contract the greater is the incentive for the contractor to try-out and apply new technologies and to optimize resource allocation.

Well-qualified contractors and inspectors are key to the success of PBC. Training programs which have been conducted for small-scale enterprises and inspectors in Uruguay and Honduras have shown good results. Equally, traditional contractors require training in modern management techniques and the application of new maintenance procedures and technologies.

Proper performance monitoring and strict application of penalties for non-compliance have proven to be critical to the success as well. Wherever road administrations did not properly monitor the performance of the contractor or did not apply proper penalties for non-compliance, contractor's performance was deficient.

Performance indicators need to be developed further. The development of performance indicators is still in its early stage. Until now each road administration has developed its own indicators by slightly modifying the ones they used before for in-house labour or contractors.

PBC might not result in cost savings immediately. Until now several countries have reported substantial cost savings. All of these countries a well developed contracting industry. As for developing countries with limited experience in contracting-out road maintenance and with a less qualified contracting and consulting industry, contracts might turn out to be more expensive than expected. Proper contract design and training might help to reduce such risk.

The principal advantage of contracting out road maintenance based on performance indicators is its potential for reducing road maintenance costs and improving road conditions. Another important advantage of this new contracting scheme is that the users know exactly the road conditions they can expect and demand. Unfortunately, improper implementation of this scheme could backfire and produce adverse effects. It is to be expected that contracting out road maintenance based on performance standards will quickly spread all over the world and eventually will replace the traditional way of contracting out road maintenance based on unit prices.

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Note: Additional documents on Performance-Based Road Management and Maintenance Contracts can be found on the Website: <http://www.zietlow.com/docs/engdocs.htm> and <http://www.performance-based-road-contracts.com>

