



CAREC TRANSPORT KNOWLEDGE SERIES

# PERFORMANCE BASED ROAD MAINTENANCE CONTRACTS – REFERENCE NOTE

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## NOTE

The Central Asia Regional Economic Cooperation (CAREC) Transport Knowledge Series is being produced to support CAREC member countries in addressing priorities identified in the CAREC Transport and Trade Facilitation Strategy 2020.

The manuals are living documents and is intended to be developed further, based on real experiences of CAREC member countries.

The current draft versions of the manuals are being circulated to CAREC countries and development partners with the following intentions:

- 1) That the contents may be immediately useful to member countries.
- 2) That feedback can be received to further improve the draft.

Please provide any such feedback to Ko Sakamoto, Transport Specialist, Asian Development Bank at [ksakamoto@adb.org](mailto:ksakamoto@adb.org)

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## Contents

About the Author.....	ii
List of Figures .....	v
List of Tables .....	v
List of Boxes .....	v
Glossary of Terms .....	vi
Executive Summary.....	vii
Objectives and Purpose of this PBC Reference Note .....	1
1. Introduction.....	2
1.1 What are Performance Based Contracts? .....	2
1.2 Brief History of PBCs .....	3
1.3 Advantages and Disadvantages .....	4
2. Basics of PBC Concept .....	7
2.1. Types of PBCs and their Scope.....	7
2.2 Performance Levels.....	12
2.3 Payment and Incentive Systems.....	15
2.4 Performance Monitoring.....	17
2.5 Risks and Risk Mitigation.....	17
3. Implementation Experiences .....	21
3.1 Developed Countries .....	22
3.2 Developing and Transitional Countries .....	26
3.3 CAREC Countries .....	31
4. Lessons Learned .....	34
5. PBC Implementation Strategy in CAREC countries .....	36
5.1 Create an Enabling Environment and meet Preconditions .....	36
5.2 Design a PBC Well .....	38
5.3. Procure a PBC Well .....	42
5.4 Implement a PBC Well.....	46
6. Recommended Options for Pilot PBCs in CAREC Member Countries .....	47
6.1 Option 1: Routine Maintenance, 3-4 Years, 100-150km.....	47
6.2 Option 2: Routine and Periodic Maintenance, 5-6 Years, 150-200km.....	48
6.3 Option 3: Routine and Periodic Maintenance, 5-6 Years, 700-1000km.....	49
6.4 Comparison of Options .....	50

7. Role of International Financial Institutions.....	53
References .....	54
Appendix 1: Types of PBCs.....	57
Appendix 2: Framework for the analysis of capacities of road organizations, contractors and consultants .....	58
Appendix 3: List of Bidding Documents Available Online.....	60
Appendix 4: List of other PBC Related Documents and Presentations Available Online.....	61
Appendix 5: Management Services (adapted from World Bank 2006).....	62

## List of Figures

<b>Figure 1:</b> Potential Scope of Works and Services of PBCs .....	8
<b>Figure 2:</b> Relationship between Contract Scope, Complexity and Duration in Years.....	10
<b>Figure 3:</b> Relationship of Required Contractor's Skills as a Function of the Duration of PBCs.	11
<b>Figure 4:</b> Contractual Relationship between client, contractors and supervision consultants for Hybrid Type PBCs .....	12
<b>Figure 5:</b> Risk sharing for different contract types .....	18
<b>Figure 6:</b> Complexity of Selected PBCs and their duration in years.....	21
<b>Figure 7:</b> Contracts used for Network Maintenance Management in New Zealand .....	24
<b>Figure 8:</b> Workforce Reduction in the Estonian National Road Administration .....	26
<b>Figure 9:</b> Comparison of Winter Maintenance Unit Costs for the Pilot Projects against Costs from Central Serbia .....	27

## List of Tables

<b>Table 1:</b> Reported Savings of PBCs against Conventional Contracts .....	4
<b>Table 2:</b> Example of Performance Levels .....	14
<b>Table 3:</b> Relationship between Traffic Volume, Performance Levels and Response Times .....	15
<b>Table 4:</b> Example Payment Reductions for Non-Compliances with Performance Levels.....	16
<b>Table 5:</b> Risk Distribution between Client and Contractor and How They Might be Mitigated...	20
<b>Table 6:</b> Annual Routine Maintenance Cost (\$) per kilometre .....	33
<b>Table 7:</b> Performance Monitoring Compliance Rating .....	33
<b>Table 8:</b> Site Selection Criteria for Pilot site in Indonesia .....	39
<b>Table 9:</b> Qualifications of Key Personnel .....	44
<b>Table 10:</b> Evaluation Criteria and Weights Applied for the Award of the Performance Contract in Washington D.C. ....	45
<b>Table 11:</b> Different types of PBCs.....	57
<b>Table 12:</b> Framework for assessing the capacity of the government, contractors and consultants .....	59

## List of Boxes

<b>Box 1:</b> Reducing road maintenance cost through completion and the introduction of performance based road maintenance contracts .....	5
<b>Box 2:</b> Road Conditions in Developing Countries in the 1980s .....	6
<b>Box 3:</b> Importance of Timely Road Maintenance –Rule of Thumb .....	7

## Glossary of Terms

<b>Terms</b>	<b>Definition</b>
ADB	Asian Development Bank
CAREC	Central Asia Regional Economic Cooperation
CREMA	Spanish abbreviation for “Road Rehabilitation and Maintenance Contract”
Emergency Works	Emergency Works are defined as necessary and sufficient activities to reinstate the road and reconstruct its structure or right of way strip damaged as a result of natural phenomena with unforeseen consequences, such as strong storms, flooding, earth quakes and avalanches
IFI	International Financial Institution
Input Contract	Payments are made on the amount of resources consumed e.g. \$/m <sup>3</sup> of material, \$/hr for labour or plant
Improvements	Activities to improve the functional performance of road assets e.g. widening of the road, providing additional assets like weigh bridges
MIS	Management Information System
OPRC	Output- and Performance Based Road Contract
Output Contract	Payments are made on the basis of outputs e.g. \$/km of resurfacing. The contractor takes the risk on the resources, quality and quantity of works and services.
Outcome Contract	Payments are made on the basis of quality or performance levels of the assets maintained over a longer period. The contractor takes the risks on the quantity and quality of resources of works and services.
PBC	Performance Base Road Maintenance Contract
Periodic Maintenance	Refer Resurfacing
Performance Levels	Quality criteria which define the minimum condition of an asset, for example potholes shall not be greater than 10cm in any direction.
PMMR	Performance Based Management and Maintenance of Roads
Programme of Performance	Management services, which cover work programme, operational plans, quality assurance plan, health and safety management plan, environmental management plan, risk management plan, emergency procedures and contingency plan, traffic management plan and information management plan.
Service Levels	Refer Performance Levels
Road Organization	Organizations in charge of the management and operation of roads (Departments of Public Works, Road Administrations, Road Agencies, etc.)
Routine Maintenance	Routine maintenance are activities, normally reactive, to restore conditions of road assets like repair of potholes, sealing of cracks, repairing and cleaning of road signs, cleaning of drains or grass cutting
Rehabilitation	Reinstatement of the carrying capacity of the pavement layers.
Resurfacing	Restoring the wearing course of a paved surfaces or re-gravelling of a gravel surfaces
Winter Maintenance or Winter Services	Activities to keep the road passable and safe in winter conditions
WB	World Bank

## Executive Summary

1. Road maintenance and asset management are one of the top priorities of the Central Asia Regional Economic Cooperation (CAREC) Transport and Trade Facilitation Strategy 2020 (TTFS 2020). The implementation of Performance Based Contracts (PBC) is an essential element of Road Asset Management (RAM)<sup>1</sup>, since it contributes to improving the effectiveness and efficiency of the maintenance of the road network. When designed well, PBCs keep roads in predefined good condition at relatively low cost. In particular, long term PBCs require sound road asset management tools and are often referred to as Road Asset Management Contracts.
2. The objective of this reference note is to assist CAREC member countries to better understand the concept of PBCs and serve as guidance for the implementation of such contracts. The note concentrates on road maintenance and does not cover other PPP road delivery models like Design, Build, Finance, Operate and Maintenance models or any of its variations, e.g. Design-Build (DB), Design-Build-Operate (DBO), Design-Build-Finance-Operate (DBFO), and Design-Build-Operate-Maintain (DBOM).
3. This note is addressed to high level policy makers as well as technical staff in CAREC member countries, ADB staff and other development partners involved in the road sector.
4. The reference note describes the different delivery modes of road maintenance, gives a brief overview of the history of PBCs and discusses the advantages and disadvantages of implementing the new contracting system. It also defines various types of PBCs with all the variables such as scope, duration, extension, performance levels, payment and incentive systems, performance monitoring and risks and risk mitigation.
5. The implementation of some PBCs in developed as well as developing and transitional countries, including CAREC countries is discussed to see what has worked and what has not. From the developed countries, PBCs in Canada, New Zealand, United States of America and Estonia are considered. Insights from developing and transitional countries are taken from Serbia and Montenegro, Argentina, Uruguay, Malaysia and Indonesia. Amongst the CAREC countries, samples from Afghanistan, People's Republic of China (PRC), and Tajikistan are considered.
6. Important lessons learned from implementing PBCs are as follows:
  - PBCs deliver good value for money and can better guarantee sufficient funding for road maintenance and improved road conditions to help to reduce road user cost and improve road safety on a sustainable basis.
  - PBCs save substantial amounts of road rehabilitation and reconstruction work. As a rule of thumb: \$1 spent in time on routine maintenance will save \$3 - \$5 at a later period on necessary rehabilitation or reconstruction works (in constant prices).

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<sup>1</sup> Road Asset Management is a strategic and systematic process of design and implementation of a road sector policy and the management of road the sector institutions as well as the financing, managing, planning, maintaining,

- Successful implementation of PBCs requires (i) an adequate Road Asset Management System (RAMS); (ii) strong commitment and support by key decision makers, particularly from the Ministry of Finance, the Ministry in charge of roads and the Road Organization; (iii) genuine engagement from Road Organization staff, and (iv) sufficient capacity from all stakeholders including staff from the client, contractors and consultants.

7. The reference note outlines a strategy on how CAREC member countries can start utilizing PBCs in their favor. It discusses how to create an enabling environment and identifies preconditions that will enhance successful implementation. It considers approaches on how to design, procure and implement PBCs well.

8. In relation to design, the reference note considers (i) the required technical studies; (ii) the design of tender documents; (iii) data to be supplied to tenderers; and (iv) supervision arrangements.

9. For procurement, the reference note discusses (i) the pre-qualification of contractors; (ii) the organization of pre-bid seminars for pre-qualified contractors; (iii) bid evaluation; (iv) preparation of tender documents for supervision or coaching and training consultants – and their respective qualification criteria.

10. Implementation necessarily includes coaching and training of client and contractor stakeholders and the establishment of adequate monitoring and evaluation processes.

11. The reference note suggests 3 practical options for CAREC member countries to start implementing pilot PBCs:

- Option 1: PBC for routine maintenance including winter services for 3 to 4 years for between 100 and 150 km of paved roads;
- Option 2: PBC for routine and periodic maintenance including winter services for 5 to 6 years and between 150 and 250 km of paved roads;
- Option 3: PBC for routine and periodic maintenance for 5 to 6 years for an extended paved road network of between 700 and 1,000 km.

12. Each option is discussed with regard to suitable road conditions, scope of works and services, payments, service levels, project delivery and contract supervision.

13. Finally, the role of International Financial Institutions in supporting implementation of PBCs in CAREC countries is also discussed.

## Objectives and Purpose of this PBC Reference Note

14. The Transport and Trade Facilitation Strategy 2020 (TTFS 2020), endorsed at the 12th CAREC Ministerial Conference on 23–24 October 2013 in Kazakhstan, highlighted three operational priorities to improve the region's competitiveness and expand trade among CAREC economies and with the rest of the world. These are (i) the development of a multimodal corridor network, (ii) improvement of trade and border-crossing services, and (iii) improvement of operational and institutional effectiveness.

15. Maintenance or Road Asset Management (RAM) is a key issue under the third operational priority to improve operational and institutional effectiveness. Many CAREC countries continue to face challenges in meeting adequate levels of financial and technical inputs in maintaining existing and new assets. A key feature of a RAM program is about knowing what is needed over a long term in order to set targets, budgets, and ensure performance of the transport network. Implementing a RAM is an organization wide activity, requiring a diverse skill set. There are clear guidelines and standards to follow, and implementation of a RAM on a permanent basis requires strong leadership.

16. Closely related to effective RAM is the use of performance based contracts (PBCs). It is now generally accepted that PBCs, if structured and applied appropriately, may provide an entry point to develop prerequisite conditions for an effective RAM system. The 14th Transport Sector Coordinating Committee Meeting (TSCC) in April 2015 reconfirmed the keen interest of CAREC countries in introducing such mechanisms. At the same time, the definition, scope and implementation arrangements for PBCs are not consistently used across the development community, leading to confusion and in worst cases inappropriate/ineffective application of the concept to projects. This is particularly true in cases where conditions specific to the country were not taken into account when the PBC was designed and introduced.

17. This reference note is intended to serve CAREC member countries in better understanding the concept of performance based road contracts and serve as guidance for the implementation of such contracts. The note concentrates on road maintenance and does not cover other PPP road delivery models, such as Design, Build, Finance, Operate and Maintenance models or any of its variations (DB, DBO, DBFO, DBOM).

18. This note is addressed to high level policy makers as well as technical staff in CAREC member countries, ADB staff and other development partners involved in the road sector.

19. It is meant to be a living document, and to be updated from time to time in the future, reflecting the collective knowledge of CAREC member countries in applying PBCs in their road maintenance and operations.

## 1. Introduction

### 1.1 What are Performance Based Contracts?

20. Road maintenance has traditionally been the realm of public road organisations. However, there is now a global trend for such work to be contracted out to the private sector. The main reason for shifting to contracts is to improve efficiency. Provided that there are good qualified road maintenance contractors with adequate competition, cost savings of between 30% to 50% have been realized (Frost, 1996 and Zietlow, 2015). Many countries in the CAREC region are still performing road maintenance in-house, especially routine road maintenance, while others use contractors to deliver road maintenance.

21. In the above context, three types of road maintenance contract have been pursued by road authorities across the world;

- *Method based or conventional contracts* with unit rates for work items and payments based on quantities of completed works;
- *Performance based contracts (PBC)* with performance levels defined for each road asset or service provided under the contract with fixed payments if performance levels are met, or payment reductions for non-compliance;
- *Mixed or hybrid PBCs* which contain elements of both contract types.

22. Most PBCs worldwide are mixed or hybrid PBCs, where the majority of works and services are performance based. Emergency, major rehabilitation and improvement works are often paid on the basis of unit prices and quantities of work completed. Some works PBCs contain output based work items such as specified improvement works or rehabilitation works, which may be described, for example, as a number of kilometres of a defined overlay per year, which are paid on a lump sum basis. These contracts are also referred to as Output and Performance (Outcome) Based Contracts<sup>2</sup>. There is no common and agreed terminology for PBCs. Each country is using different denominations and they differ in the scope, method of payments, duration and management arrangements<sup>3</sup>.

23. All PBCs have in common that the contractor needs to maintain the road assets in predefined good conditions or service levels during the entire contract period. Payments are based on how well the contractor manages to comply with the performance or service levels defined in the contract, and not on the amount of works and services executed. It is up to the contractor how to achieve this. Therefore, work selection, design and delivery are all his responsibility. Hence, the choice and application of technology and the pursuit of innovative

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<sup>2</sup> World Bank uses the term Output and Performance-based Road Contract (OPRC). Same countries like New Zealand use the term Output instead of Performance.

<sup>3</sup> For example: Performance Contract (Western Australia), Asset Management Contract (USA), Performance-Specified Maintenance Contract (Australia, New Zealand), Contract for Rehabilitation and Maintenance (Argentina, Brazil), Area Maintenance Contract (Finland, Ontario/Canada), Managing Agent Contract (UK), Output and Performance Road Contract (World Bank).

materials, processes and management are all up to the contractor as long as he complies with the relevant laws and regulations. This allocates higher risk to the contractor compared to conventional contract arrangements, but at the same time opens up opportunities to increase profit margins where improved efficiencies and effectiveness of design, process, technology or management are able to reduce the cost of achieving the specified performance levels.

## **1.2 Brief History of PBCs**

24. The development of PBCs started in the late 1980s and early 1990s. In 1988, British Columbia in Canada started to contract out road maintenance to the private sector introducing some performance levels for routine maintenance. Two years later, Argentina contracted out almost half of its national roads using end result performance specifications for maintenance services including periodic maintenance and spot rehabilitations, with a penalty system for not meeting response times for rectifying deficiencies.

25. During the 1990s many countries in Latin America such as Uruguay, Chile, Peru and Brazil started their first PBC pilot projects. At the same time PBCs developed in Australia and New Zealand as well as in the United States of America and Finland, Denmark and Estonia. Many other countries followed after the year 2000.

26. Almost all countries which were in the early stage or preparing to launch PBCs have implemented contracts by now. Several other countries have followed since then. In some countries PBCs have replaced the conventional way of contracting out road maintenance almost entirely, like in Canada and Argentina. The rapid adoption of PBCs worldwide indicates that such contracts deliver better value for money than conventional contracts and are able to guarantee good road conditions at the same time. It is expected that this trend will continue and PBCs will eventually replace the conventional way of contracting out road maintenance.

### 1.3 Advantages and Disadvantages

27. The main reason why developed countries have switched from conventional contracting out road maintenance to PBCs is the potential for cost savings. Reported savings are typically between 15% and 30% when compared with the same scope of works undertaken by conventional unit price contracts. Table 1 illustrates reported savings in select countries.

**Table 1:** Reported Savings of PBCs against Conventional Contracts

Country	Reported Savings against Conventional Unit Price Contracts
<b>Alberta, Canada</b>	About 20%
<b>Australia</b>	10 – 40 %
<b>Brazil</b>	15% - 35%
<b>Estonia</b>	20 -40%
<b>Holland</b>	30-40 %
<b>New Zealand</b>	15 – 38%
<b>Norway</b>	20 – 40%
<b>Finland</b>	18%
<b>USA</b>	10-15%

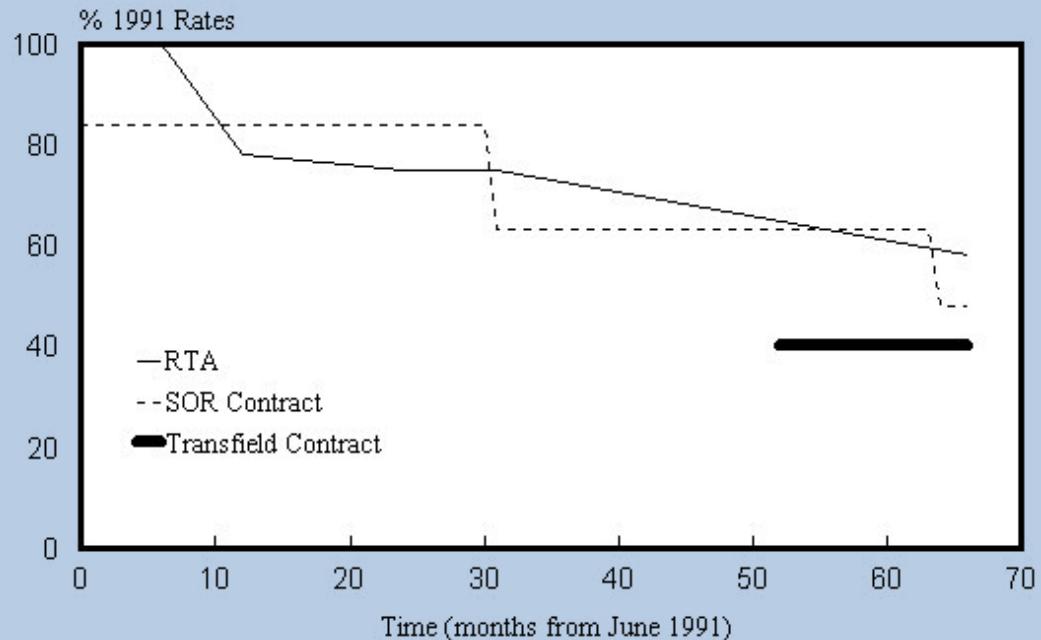
Source: Pakkala et al. 2007

28. Generally, cost reductions were largest when contractors faced strong competition and have gained experiences with PBCs. Since PBCs are fixed price contracts, contractors have an incentive to maintain the contracted performance levels at the lowest cost possible. The longer the contract duration, the higher is the incentive. Besides competition, modern management and work procedures, increased labour productivity, total life cycle costing, just in time maintenance and better use of latest technologies have driven down cost. A well-documented case for demonstrating the importance of good competition for driving down cost is illustrated in Box 1. A word of caution is required. When there is a lack of competition the expected savings might not be realized.

**Box 1:** Reducing road maintenance cost through competition and the introduction of performance based road maintenance contracts

In 1990 the Road Transport Authority (RTA) of New South Wales initiated the development of a pilot road maintenance contract project in the Sydney region. The objectives of the pilot were to establish the feasibility of contracting road maintenance and to measure differences in cost, quality, and responsiveness between a contractor and the RTA workforce. RTA initiated a pilot by choosing two equal long road sections of 100 km with similar road conditions. One section was given to an RTA team to maintain and the other one contracted to the private sector for 2 years and twice retendered after 2 years each. Both the RTA team and the contractor were supervised by a consultant and were subject to the same technical specification, which defined the level of performance, in terms of intervention standards. The graph below illustrates how good competition can reduce maintenance cost over time. After the third tender round, maintenance cost was reduced by 48%. In addition, the 5-year performance contract on urban roads in Sydney produced even more savings.

This example demonstrates that (i) shifting from in-house works to contracting out based on conventional maintenance contracts with unit prices produces significant savings, and that (ii) further savings are possible by introducing performance based contracts. In this case the total savings amounted to more than **60%** compared to the cost of delivering maintenance in-house.



Source: Improving Quality and Costs Through Performance Contracts, RTA 1996. Frost. 1996. For more information, refer to <http://www.zietlow.com/docs/frost.htm>

29. For developing countries, the main driving force to introduce PBCs is to secure sufficient long-term financing for road maintenance and guarantee better road conditions. Good examples are Malaysia, Argentina and Uruguay.

30. For the same reason, Malaysia introduced area-wide PBCs in the year 2000 with 15-year duration on all its national roads and was successful in securing sufficient road maintenance funds during the entire contract period. The same applies to Argentina and Uruguay. Even during the economic crisis in both countries in 2002, the governments honored their commitment towards all PBCs. In most of the other developing countries, especially in Africa and Asia, the International Financial Institutions (IFIs), led by the World Bank, convinced governments to explore PBCs by financing pilot projects with the long term view to improve both long term sufficient road maintenance funding and road network conditions.

31. Previously the IFIs concentrated their road sector lending on road construction and rehabilitation, and left the borrowers to take care of road maintenance with mixed results. Little has changed since the 1980s, see Box 2. Sustainability of road projects is a major concern for IFIs, and this has resulted in a shift in road sector lending policies.

**Box 2: Road Conditions in Developing Countries in the 1980s**

Despite their importance, road networks in many developing countries are still underfinanced, poorly managed and badly maintained.

- Normally, only 20% to 40% of the amounts required are spent on routine and periodic maintenance.
- 1/3 of the main road networks are good, 1/3 in regular and 1/3 in poor conditions

Sources: World Bank 1988 and Heggie and Vickers 1998

32. Besides the potential to reduce road maintenance costs and secure long term financing, PBCs help:

*Road Agencies to*

- save on rehabilitation cost, since roads in good condition avoid rehabilitations
- safeguard against cost overruns by frequent claims and contract amendments to increase quantities of work
- reduce work load of staff
- improve the quality of works
- improve control and enforcement of performance levels
- improve road safety

*Road users to*

- save on road user cost

- encounter better and safer roads with consistent conditions

*Contractors and Consultants to*

- guarantee a consistent workload over longer periods
- improve the potential for increased margins
- develop excellent opportunities for business growth

33. The enormous savings offered by reducing or delaying road rehabilitation or reconstruction<sup>4</sup> costs, and reducing road vehicle operating costs, surpass by far the costs of a disciplined maintenance regime, see Box 3.

**Box 3: Importance of Timely Road Maintenance –Rule of Thumb**

When roads are in poor condition every \$ not spent on road maintenance will COST:

- \$ 4 to 5 to road users in additional vehicle operating cost, travel time losses and additional accidents
- \$ 6 to 18 to the road organization in reconstruction and rehabilitation cost

Sources: Burningham and Stankevich 2005, Smart Growth America 2011 and Author

34. The above mentioned benefits provide compelling justification to implement long-term PBCs. This is especially true for developing countries with a history of insufficient road maintenance funding and relatively poor road conditions.

## 2. Basics of PBC Concept

### 2.1. Types of PBCs and their Scope

35. In developing and transitional countries **five types of PBCs** are typically being used:
- Due to the prevalence of poor road conditions, PBCs that require **major capital works (initial rehabilitation and periodic works)** comprising more than 30% of the total contract price, besides routine maintenance and winter maintenance (where required), are the most common. Such contracts are also known as OPRC or Rehabilitation and Maintenance Contract (RMC) or CREMA (In Spanish: Contrato de Rehabilitación y Mantenimiento).
  - PBCs which require **no or little initial works** to bring roads to the required service levels, besides routine maintenance and winter maintenance (where required), and periodic maintenance. This contract type is also referred to Network Management PBCs, Performance Specified Road Maintenance Contract (PSRMC) or Performance-based Management and Maintenance of Roads (PMMR).

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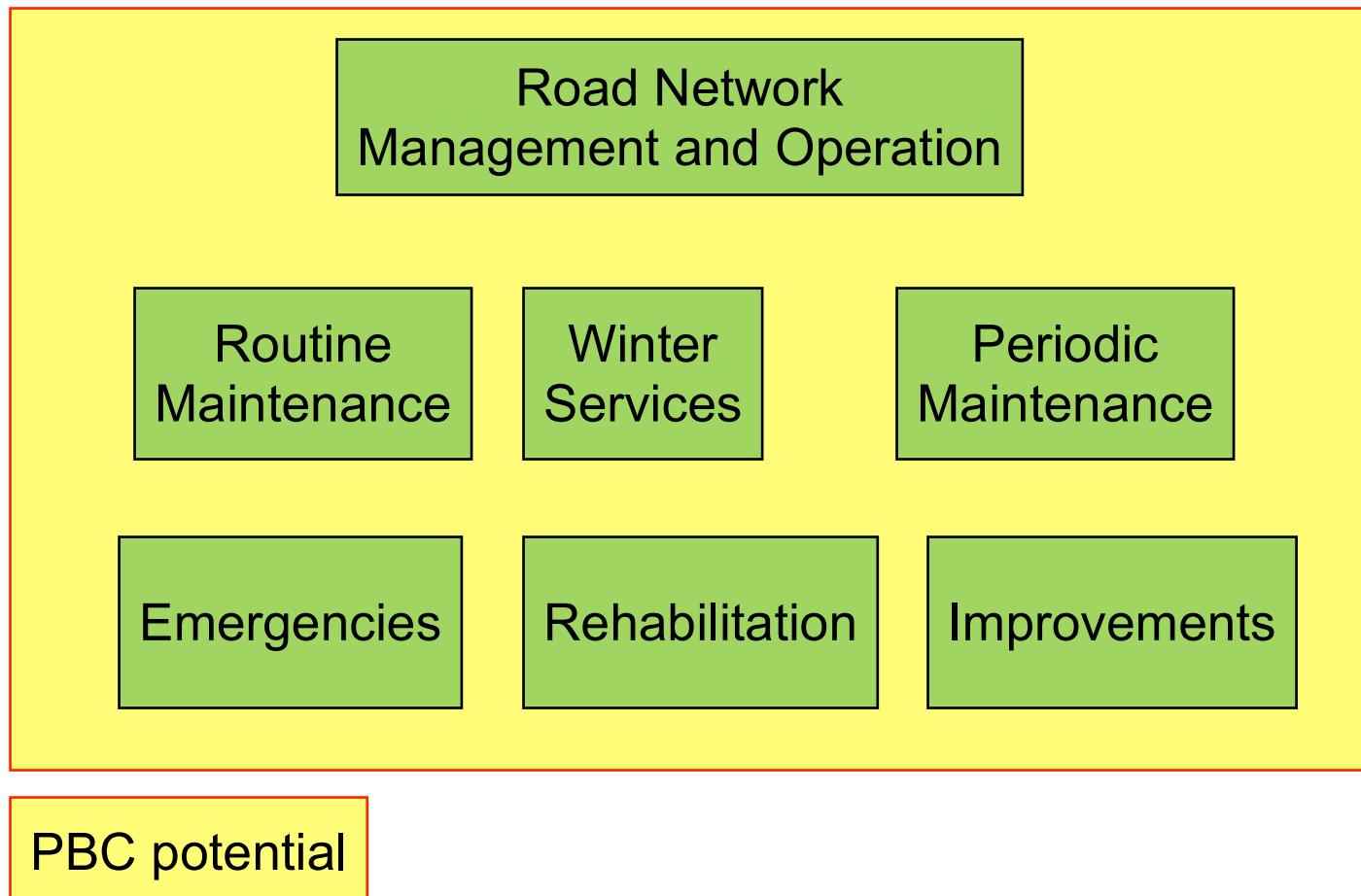
<sup>4</sup> Reconstruction is defined as renewing the entire road structure, while rehabilitation refers to the replacement of the base course and the road surface (surface course, binder course and asphalt course)

- PBCs for **routine and winter maintenance**, if required. This contract type is also known as Service Level Maintenance Contract.
- Simple PBCs for **routine maintenance on unpaved roads**. This contract type is known as Community Based Maintenance Contract.
- Simple PBCs for **routine maintenance on paved roads**. This contract type is also known as Microenterprise PBC mainly applied to community based roads<sup>5</sup>.

36. PBCs are being applied on national, provincial, local and urban paved or unpaved roads and vary in scope and duration. The different types of PBCs mainly used in developing countries are discussed in Appendix 1.

37. The **potential scope of works** and services which can be covered under PBCs are illustrated in Figure 2.

**Figure 1:** Potential Scope of Works and Services of PBCs



Source: Zietlow 2009

<sup>5</sup> Refer to ADB 2011, Zietlow 2004 and World Bank 2008.

38. The scope of works and services of PBCs may cover routine maintenance only or one or several of the other works and services involved in road network management and operation, winter services, periodic maintenance and emergency, rehabilitation and improvement works. At the same time works and services may cover all or some road assets typically including:

- paved areas of roads, parking areas, lay-bys, footways and the like;
- unpaved shoulders, medians and verges;
- signs, road markings and road safety furniture like guard rails and delineators;
- road lighting and associated facilities;
- bridges, tunnels, culverts, earth retaining structures and other structures;
- drainage structures like drainage ditches, pipes, manholes and related items;
- slopes of cuttings and embankments;
- landscaped areas;
- miscellaneous facilities such as weigh bridges, bus shelters, rest areas, weather stations and the like.

39. Road Network Management and Operation covers:

- Management Services inclusive of:
  - management information system (MIS)
  - contractor's works program
  - reporting
  - quality assurance system
  - health and safety management plans
  - environmental management plan
  - emergency procedures and contingency plan
  - traffic management plan
  - inventory database management
  - inspections
- Operation of weather stations
- Traffic management
- Road patrols
- Emergency telephones and road side assistance
- Operation of weigh scales

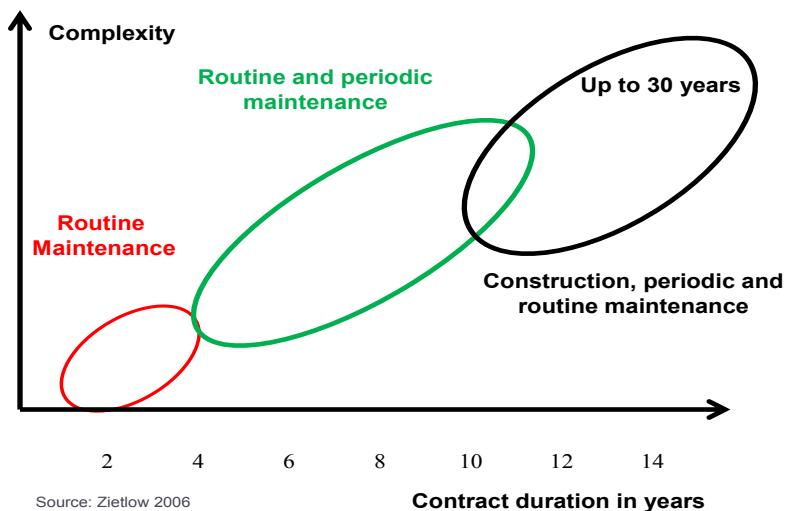
40. In order to minimize interference with other contractors on the same road, or disputes as to responsibility, it is recommended to let as much works and services as possible under one PBC on a specific road.

41. The **duration of PBCs** varies from 1 year to 30 years. As a rule of thumb, contract duration shall cover at least one periodic maintenance cycle. This is 4-5 years for unpaved roads and 8 to 10 years for paved roads. 1 to 4-year PBCs are common when road

organizations start to shift from conventional contracts to PBCs<sup>6</sup> in order to gain experiences with this new type of contract. 4 to 10-year PBCs normally cover routine and periodic maintenance, winter services (where required), emergency works and sometimes spot rehabilitation and improvement works.

42. Contracts covering more than 10 years normally cover the entire scope of works and services and often new construction works as well. Such contracts are common for road concessions with or without tolls. The longer the PBC contract period, the greater the complexity therefore requiring increased contractor asset management skills. Figure 3 illustrates the relationship between scope, contract complexity and contract duration.

**Figure 2:** Relationship between Contract Scope, Complexity and Duration in Years



Source: Zietlow 2009

43. In developing countries, where road conditions have deteriorated to an extent where major rehabilitation works are required to bring up roads to maintainable conditions, major rehabilitation works are often part of PBC contract scope. Such contracts normally range from 3 years to 5 years<sup>7</sup>. Since initial rehabilitation works often represent more than 50% of the contract amount, such contracts tend to attract contractors who are more interested in the capital works rather than the maintenance works and tend to give little attention to PBC components. Since many developing countries are faced with the same situation of having roads that cannot be maintained by maintenance works only, it is recommended to extend such rehabilitation and maintenance PBCs to at least 8 years. This will incentivise contractors to pay more attention to the PBC components and to deliver high quality capital works.

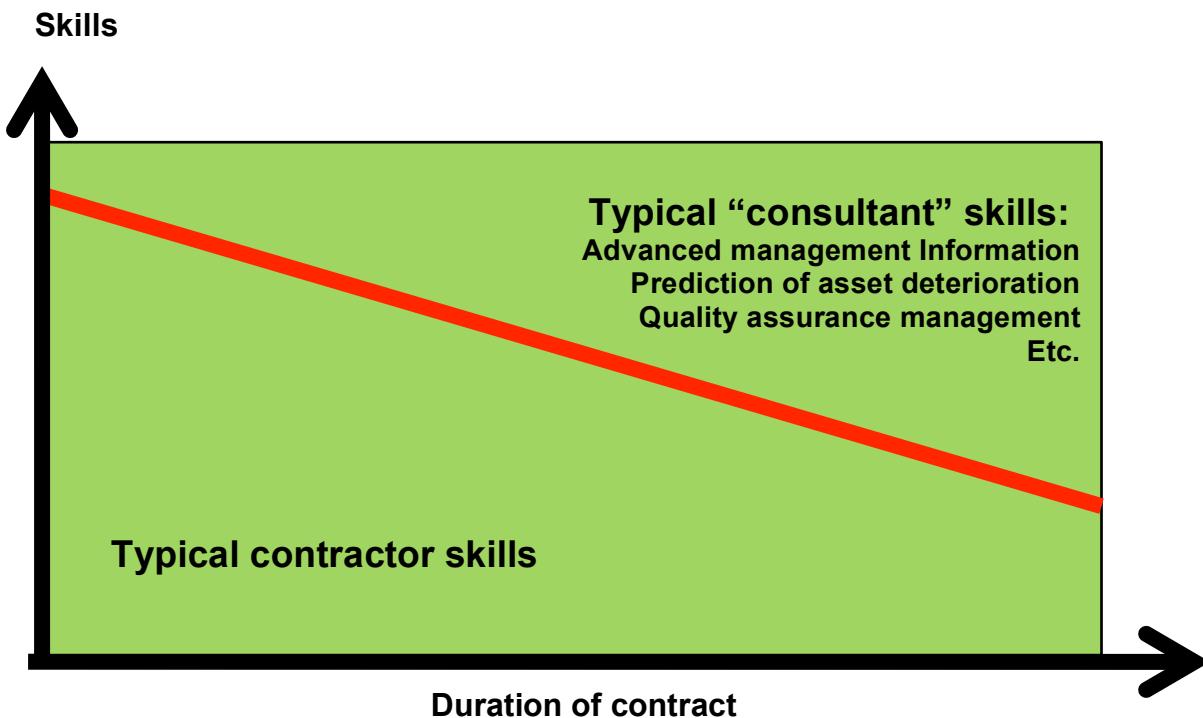
<sup>6</sup> For example Finland and Estonia started with one year routine maintenance PBCs gradually increasing the duration and scope to 8 years today, while Uruguay started with 4-year PBCs.

<sup>7</sup> 3-year contracts are common in Brazil while Argentina started with 5-year rehabilitation and maintenance contracts or known as CREMA

44. The **number of kilometres of roads covered** by PBCs varies widely. Simple contracts that include only off road routine maintenance, commonly used in rural areas, cover between 20 and 50 kilometres. These contracts are also referred to as community based PBCs<sup>8</sup>. Most other PBCs cover between 200 and 500 kilometres. Pilot PBCs tend to cover less kilometres. In exceptional cases, a PBC may cover as much as 7,000 kilometres of roads, as in Malaysia.

45. PBCs require a **contractor** with a specific skill set tailored to managing PBCs successfully. Instead of being told what and when and how, contractors need to develop capacity to plan their works and services to comply with predefined performance levels over the whole contract period. This requires certain skills whereby contractors can analyse the deterioration pattern of road assets by utilizing asset management systems, quality assurance management and more sophisticated management information systems. These skills are presently more likely to be found with consultants. The longer and more complex the PBC, the more contractors need such skills, see Figure 4. If contractors do not have such qualifications they would have to acquire them, for example, by employing qualified consultants.

**Figure 3:** Relationship of Required Contractor's Skills as a Function of the Duration of PBCs



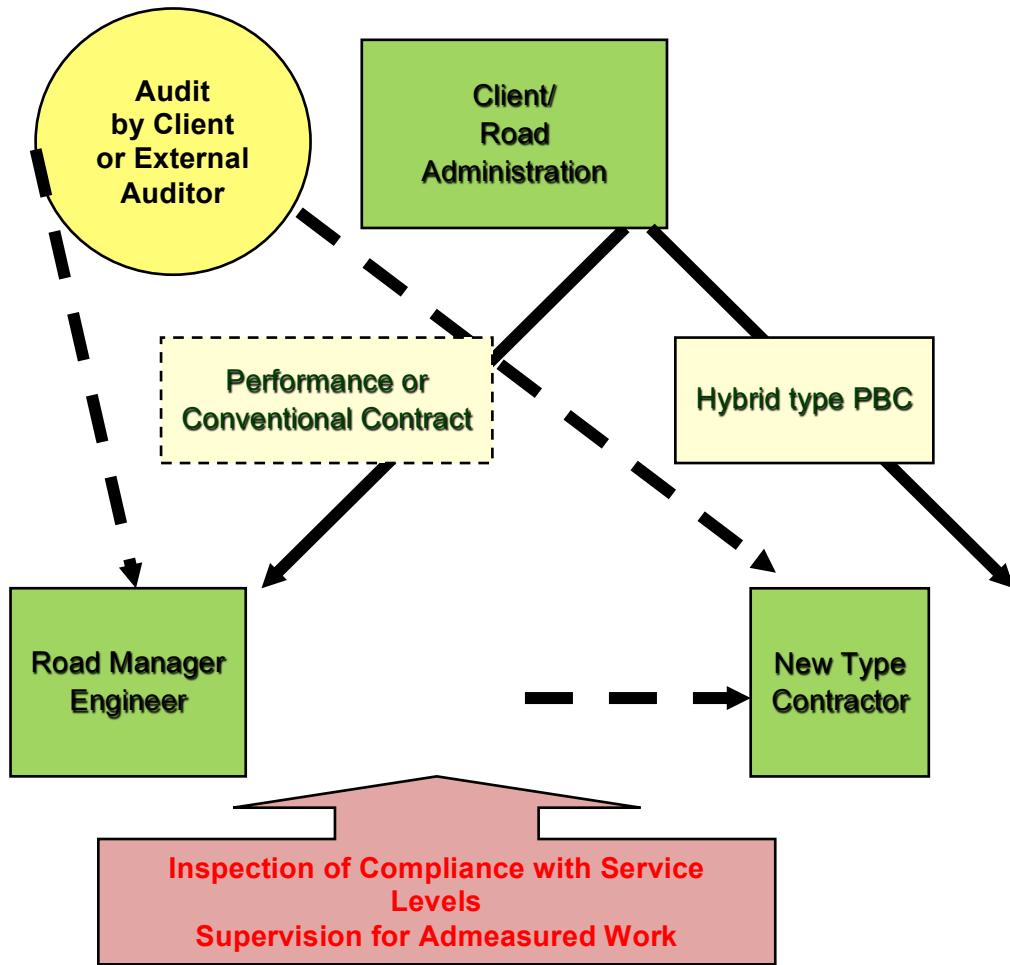
Source: Zietlow 2015

46. PBCs require a different **contractual relationship between client and contractor**. In a PBC where all works and services are paid on performance the client concludes the contract with a performance audit, which can be conducted by the client or an external consultant or

<sup>8</sup> [www.zietlow.com/docs/me.pdf](http://www.zietlow.com/docs/me.pdf) and <http://www.adb.org/sites/default/files/publication/28942/guide-road-maintenance-womens-groups.pdf>

both. In a mixed or hybrid PBC the client needs to supervise and certify admeasured works in addition to the audit functions. Figure 5 illustrates this new relationship between client, contractor and supervision consultant for hybrid type PBCs.

**Figure 4:** Contractual Relationship between client, contractors and supervision consultants for Hybrid Type PBCs



Source: Zietlow 2011

## 2.2 Performance Levels

47. Performance levels are minimum conditions of road, bridge, road side and traffic assets that have to be met by the contractor over the entire contract period and may cover other services such as winter services, the collection and management of asset inventory data, call-out and attendance to emergencies, and response to public requests, complaints and feedback.

48. Normally performance levels are grouped in two categories:

- Management performance levels, which reflect the ability of the contractor to successfully manage the contract outputs, including the provision of timely reporting information to the client regarding:

- contractor's works program
  - quality assurance system
  - health and safety management plans
  - environmental management plan
  - emergency procedures and contingency plan
  - traffic management plan
  - inventory database management
  - inspections
  - management information system, and
- Operational performance levels:
    - pavement condition
    - road marking and pavement markers
    - drainage system
    - road signs
    - vegetation control
    - winter services (where applicable)
    - incident response
    - road patrol
    - routine maintenance of bridges and structures
    - road side telephone and emergency services
    - operation of weather stations
49. Operational performance levels need to satisfy three main objectives:
- to satisfy road users with respect to accessibility, comfort, travel speed and safety;
  - to minimize total long term cost to the Road Organization and road users; and
  - to minimize environmental impacts
50. Performance levels need to align with these objectives and be easily understood, clearly defined, objectively and easily measurable, affordable, low collection cost and consistent with relevant laws and regulations.
51. The following example illustrates the relationship between objectives and performance levels:
- road safety: potholes not wider than 15 cm in diameter;
  - preservation of road asset: cracks no wider than 3 mm, obstruction of culverts less than 20% of its cross section;
  - vehicle operating cost and comfort: Roughness in IRI less than 3;
  - travel time: calculated based upon an average speed greater than 50 km/hr.
52. An example of performance levels is illustrated in Table 2.

**Table 2:** Example of Performance Levels

Item	Performance Level
<b>Potholes in pavements</b>	Permitted maximum dimension of any single pothole [ <i>insert value, the suggested value is between zero and 40 cm</i> ]. Permitted maximum number of accumulated potholes with an equivalent diameter greater than 100 mm in any continuous 1,000m section. [ <i>Insert value, suggested value is between zero and 10 per km of road</i> ].
<b>Patching</b>	Patches (i) shall be square or rectangular, (ii) shall be level with surrounding pavement, (iii) shall be made using materials similar to those used for the surrounding pavement, and (iv) shall not have cracks wider than three (3) mm.
<b>Cracking in pavement</b>	There shall be no cracks wider than 3 mm wide.
<b>Multiple cracks in pavement</b>	For any 50m section of the pavement, the cracked area cannot be more than ten (10) percent of the pavement surface. The cracked area is measured by a rectangular parallel to the centreline of the pavement with 10 cm distance between any crack and any side-line of the rectangular.
<b>Rutting</b>	There shall not be ruts deeper than [ <i>insert value between 20 and 40</i> ] mm. Rutting of more than ten (10) mm shall not be present in more than 5 percent of any of the road sections defined in the contract.

Source: Adapted from World Bank 2006

53. Due to economic considerations of optimizing total system cost, performance levels may differ with traffic levels on a road section. This is also true for response times, during which the contractor needs to rectify any non-compliances. An example that demonstrates the relationship between traffic volume, performance level and response times is illustrated in Table 3.

**Table 3:** Relationship between Traffic Volume, Performance Levels and Response Times

		Fair	Good	Very Good	Excellent
<b>Typical Traffic Volumes (Vehicles/day)</b>	< 250	250 - 1000	1001 - 5000	> 5000	
<b>Potholes (Max diameter of any single pothole)</b>	40 cm	30 cm	15 cm	0 cm	
<b>Potholes (Max number in any 1000m with diameter greater than 10 cm)</b>					
<b>Patching (Response time)</b>	28 days	28 days	14 days	7 days	
<b>Cleanliness of the pavement surface and shoulders for safety related matters (Response time)</b>	10 hrs	8 hrs	6 hrs	3 hrs	

Source: Adapted from Word Bank 2006

54. Good examples for performance levels and response times can be found in (World Bank 2006) and (Government of Punjab 2011)<sup>9</sup>.

### 2.3 Payment and Incentive Systems

55. In a PBC the contractor receives lump sum payments, usually monthly, if services are delivered in compliance with the contract defined performance levels. For any non-compliance the contractor suffers payment reductions. Some other works and services might also be paid on the basis of lump sums, like periodic maintenance, rehabilitation or improvement works. These works will be paid on work progress or when the work is completed. Liquidated damages are applied for not completing these works on time. Emergency works are normally paid on unit prices as admeasured works. In exceptional cases some routine maintenance activities are paid on unit prices if the contractor cannot realistically estimate the deterioration of the specific road asset, or the available funds do not allow for the full application of all performance levels for routine maintenance<sup>10</sup>.

56. Payment reductions are applied for non-compliance with performance levels. In the past the term penalties was used, but not well received by contractors. Also, in common law jurisdictions, penalties may be unenforceable. Therefore, the term payment reductions were introduced.

57. In some PBCs bonus systems have been applied for exceeding certain benchmarks. For example, in a PBC in the United States of America the contractor received 100% payment if he complied with 80% of the total score related to the overall performance and addition payments for better performance.

<sup>9</sup> <http://www.prbdb.gov.in/files/oprc/OPRC%20final.pdf>

<sup>10</sup> In South Africa pothole patching was paid on unit prices, but needed to be fixed within a certain response time. In the first pilot PBC Croatia did not have sufficient to comply with all performance levels and left some routine maintenance items to be paid on unit price basis.

58. The value of payment reductions should be high enough to give the contractor sufficient incentive to comply. If the payment reductions are too low contractors tend to be less compliant, if too high contractors may apply a risk premium on their tender price. Therefore, great care shall be used to determine appropriate payment reductions for each non-compliance.

59. The non-compliance with each performance level results in a specific payment reduction. For example, if a report is not submitted on time, or the average roughness of a road sections is more than specified, or a pothole exceeds the maximum diameter, payment reductions are applied. Payment reductions are expressed in amounts of the local currency or as percentages of the monthly lump sum per kilometre. Normally payment reductions are applied in the instance when the client or his representative detects a non-compliance and additional payment reduction are applied for each time period the non-compliance is in effect. Additional payment reductions are made for not correcting the deficiency within a certain response time. Payment reductions might escalate if response times are repeatedly not met. For more details of how payment reductions are applied refer section 2.4 Performance Monitoring. Example application of payment reductions are provided in Table 4.

**Table 4:** Example Payment Reductions for Non-Compliances with Performance Levels

Criteria	Performance level	Payment reduction on first inspection (% of monthly lump sum / km)	Payment reduction on subsequent inspections (% of monthly lump sum / km)
Potholes on carriage ways	Potholes shall not be wider than 10cm in any direction	5% for that one-km road section that contains the pothole	15% for that one-km section until pothole is fixed
Rutting	Rut depth shall not exceed 20 mm for a length of 3m in any 100 m section	10% applied to each 100m section which does not comply	20% applied to each 100 m section until the rutting is fixed
Vertical Signage	One or more traffic signs is absent, destroyed, non-legible, incorrectly placed or non-functional	5%	10% until signs are replaced or fixed
Vegetation	The maximum vegetation height measured anywhere in a 100 m section is above the threshold value	5% for each 100 m section	10% for each 100 m section until vegetation is trimmed to permissible height

Source: Author

60. Another payment approach can involve a scoring system. According to its importance, each non-conformance is assigned a weighting and results in a score. At the end of the months these scores are aggregated. If the total score is lower than a predefined threshold the contractor receives 100% payment. If the total score is higher than the threshold, payments are reduced up to a point where no payments will be made during the respective month<sup>11</sup>.

<sup>11</sup> This system is being used in the OPRC in Punjab. <http://prbdb.gov.in/files/oprc/OPRC%20final.pdf>

## 2.4 Performance Monitoring

61. PBCs require an effective and efficient performance monitoring and inspection system. This is mainly achieved by a self-control system of the contractor, inspections or audits by the client and supported road users.

62. In order to comply with performance levels, the contractor needs to establish adequate procedures implemented through a special unit with qualified staff. Some performance levels, like those that pose road safety hazards, need to be controlled almost constantly. Others require less frequent inspections, like road roughness or bridge inspections. Daily patrols as well as an emergency call centre are important elements of the system.

63. There are several methods used to monitor compliance. The most common ones are:

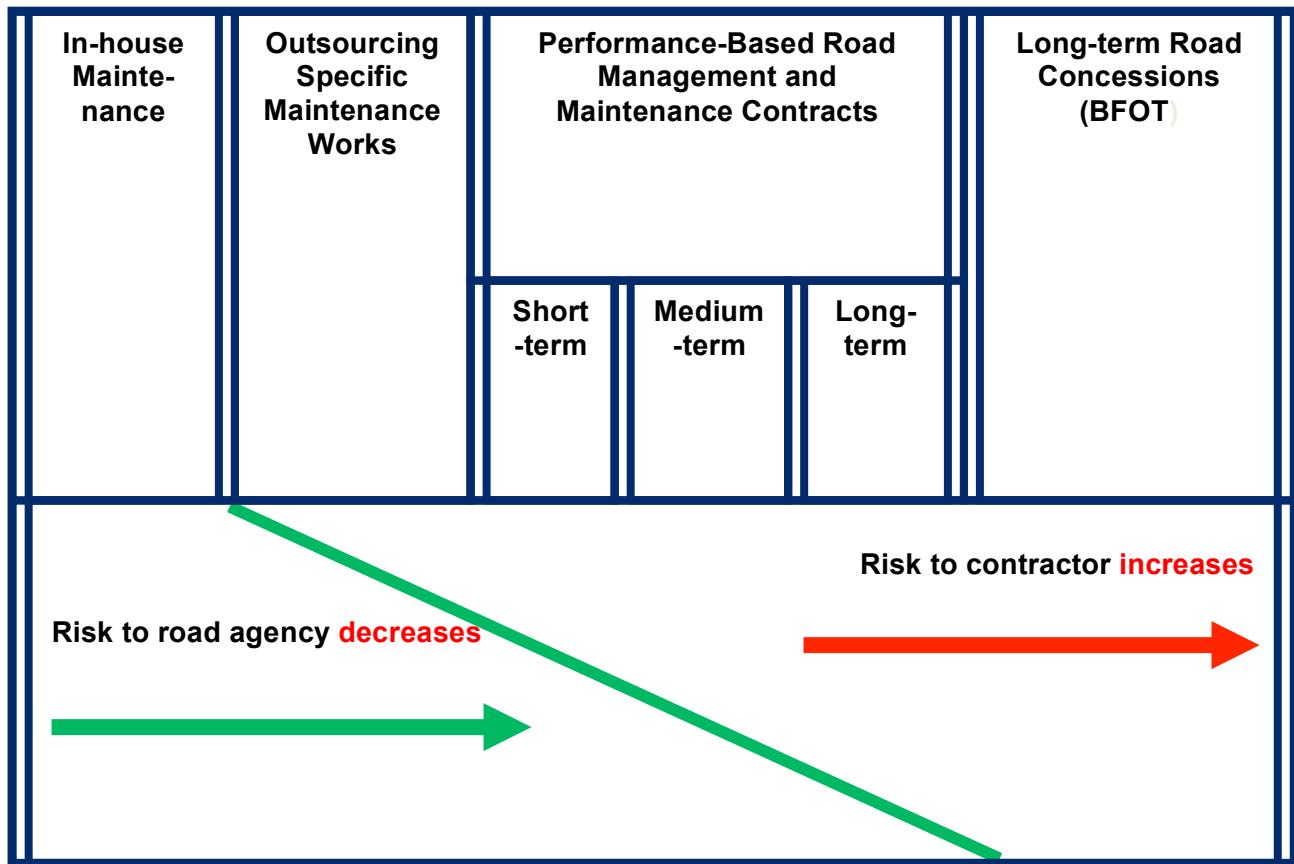
- At the end of each month the contractor submits a compliance report to the client for payment and the client makes spot checks of the correctness of the report and makes adjustments, if necessary. On this basis the payment reduction is calculated.
- At the end of each month there is a joint inspection by the contractor and the client or his representative and all non-compliances are recorded and sanctioned by payment reductions. Follow up inspections by the client verify if the contractor has rectified the deficiency within the response time defined in the contract. If not additional payment reductions are applied. In most cases only a percentage of the roads included in the PBC are inspected monthly. Road sections are chosen by random selection. In very few cases the entire road is inspected. This is applied in pilot projects with limited road length.
- The contractor records all non-compliances in a computerized, and preferably web based, management information system and is granted response times to rectify deficiencies. If he is not rectifying the deficiencies in time, payment reductions are applied automatically and will substantially increase for each further period of the response time during which the deficiency is not corrected. The client inspects the road at random selection. If he detects any non-compliance he checks whether or not the non-compliance has been entered into the management information system. If not, the contractor will have to pay a penalty in form of higher payment reductions for failing to detect the non-compliance.

## 2.5 Risks and Risk Mitigation

64. Risks management plays a bigger role in PBCs than in conventional contracts. In PBCs significant risks are transferred from the Road Organization to the contractors. Generally, the longer the contract, the more risk the contractor has to assume, as illustrated in Figure 6.

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**Figure 5:** Risk sharing for different contract types



Source: Zietlow 2009

65. PBCs require equitable sharing of risks between client and contractor. Normally contractors are willing to take some of the risks, provided that the nature of the risks relate to their expertise so that they will be able to properly assess the consequences and price them into their tenders. Asking the contractor to bear risks that could be best handled by the road organization or exceeds the ability of the contractor to realistically calculate the risks, will either result in withdrawal by contractors, excessive tender prices or in losses to the contractor.

66. There is a clear relationship between the duration of a contract and the required qualifications of contractors. For medium and long term contracts, contractors need to operate a pavement management system. This is not required for shorter contracts, say up to 4 years. Table 5 illustrates the major risks distribution between client and contractor and how they might be mitigated. There might be additional country specific risks, which need to be analysed.

67. An example of risk sharing between road organization and contractor is included in the Bidding Documents for “Procurement of Contract under Output and Performance Based Contract (OPRC), (Asset Management Contract) for Improvement, Rehabilitation, Resurfacing & Routine Maintenance Work of Roads, Government of Punjab, Appendix 3 (Government of

Punjab 2011)"<sup>12</sup>. A risk management process manual can be retrieved from web site of the New Zealand Transport Authority (Transit New Zealand 2004)<sup>13</sup>.

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<sup>12</sup> <http://www.prbdb.gov.in/files/oprc/OPRC%20final.pdf>

<sup>13</sup> <https://www.nzta.govt.nz/assets/resources/risk-management-process-manual/docs/risk-management-process-manual.pdf>

**Table 5:** Risk Distribution between Client and Contractor and How They Might be Mitigated

Risks	Client	Contractor	Mitigation
<b>Political, legal and regulatory risks</b>	X		Client needs to bear the cost
<b>Monetary and macroeconomic risks</b>	X		Client needs to bear the cost
<b>Force majeure including extreme weather conditions</b>	X		Client needs to bear the cost
<b>Lack of competition</b>	X		Contract scope and duration need to be adjusted to allow for sufficient competition. Training programs for potential contractors.
<b>Poor quality of works</b>	X		The contractor must follow the technical rules and regulations governing road works. If there are no standards for road maintenance works they need to be developed. Spot checks of workmanship and quality of material may be undertaken by the client. This is especially relevant for pilot projects.
<b>Non-compliance with service levels</b>	X		Strict application of payment reductions which need to be high enough to deter contractors from non-compliance. Escalation clauses for payment reduction shall be applied for successive non-compliance.
<b>Premature termination of the contract by the contractor</b>	X		Payment bonds shall be high enough to deter contractors from terminating contracts prematurely.
<b>Contractor doesn't have enough information to realistically estimate maintenance and winter services cost</b>	X		Client to supply the necessary data: <ul style="list-style-type: none"><li>• Construction details of the road</li><li>• Maintenance history</li><li>• Maintenance cost history</li><li>• Road asset conditions</li><li>• Winter weather history</li></ul> If data are insufficient, unit prices for critical items shall be considered, otherwise contractor will price the risk into his tender price.
<b>Unexpected growth in traffic volume or increase in overloading of vehicles</b>	X		Cost adjustment formula for unexpected traffic volume growth and unexpected increase of overloading
<b>Inflation</b>	X		Cost adjustment formula to take care of inflation reflecting the actual inputs required for the PBC.
<b>Late payment</b>	X		Client to pay interest charges 1% over the borrowing rate of the contractor.
<b>Social acceptability risk</b>	X		Involving road organization's staff early in the preparation of PBCs as well as other stakeholders.

Source: Greenwood 2005

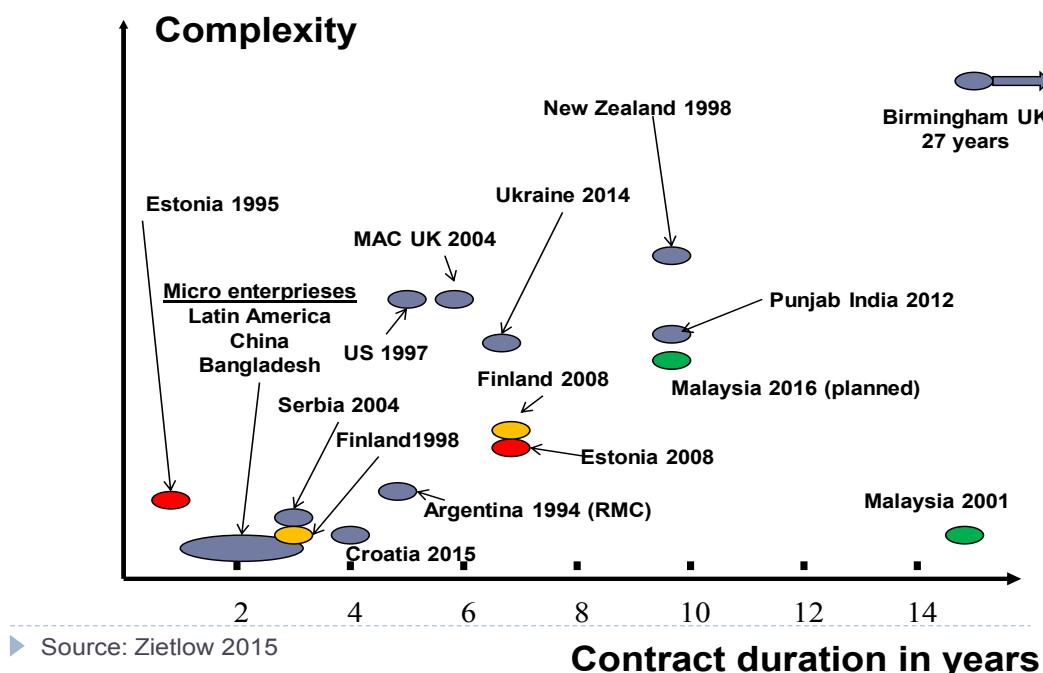
### 3. Implementation Experiences

68. PBCs have a relatively short history. The first contracts started in 1988 in Canada and gradually spread all over the world in developed as well as developing countries. The implementation of some PBCs in developed as well as developing and transitional countries, including CAREC countries is discussed to see what has worked and what has not. From the developed countries, PBCs in Canada, New Zealand, United States of America and Estonia are considered. Insights from developing and transitional countries are taken from Serbia and Montenegro, Argentina, Uruguay, Malaysia and Indonesia. Amongst the CAREC countries, samples from Afghanistan, People's Republic of China (PRC) and Tajikistan are considered.

69. PBCs in developed countries were mainly initiated by the Road Organizations themselves. The initiative to start PBCs in developing countries has usually been initiated by International Financial Institutions, in particular the World Bank (World Bank 2014B) and other Regional Development Banks as well as bilateral development programs<sup>14</sup>.

70. PBCs differ widely in their complexity and duration of contract. An overview of the contract duration and the complexity of some of PBCs in some selected countries is illustrated in Figure 7.

**Figure 6:** Complexity of Selected PBCs and their duration in years



<sup>14</sup> See: [www.zietlow.com](http://www.zietlow.com)

### 3.1 Developed Countries

71. The Province of British Columbia in Canada was a pioneer in outsourcing of road maintenance under performance based contracts in Canada in 1988. Later on, Alberta (in 1995) and Ontario (in 1996) followed. In 2006 British Columbia and Alberta maintained 100% and Ontario 60% of their provincial highways under hybrid type PBCs. All provinces took a stepwise approach starting with contracts of between 3 to 5 years' duration. While gaining experience they gradually extended the PBCs up to 10 years. Contracts include routine maintenance and winter services, patrolling and emergency assistance. Periodic maintenance (resurfacing) and rehabilitations are excluded.

72. When the Province of British Columbia first introduced PBCs they went from in-house road maintenance to performance based road maintenance contracts directly. The government employees working in the road maintenance were offered the following options:

- Accept employment with the successful contractor in the district.
- Stay with the government and fill vacant positions anywhere in the public service.
- Take the early retirement package (if they were qualified).
- Resign.
- Severance pay was not available under any option.

73. At the end of the privatization for the first round of contracts in 1988, 2,280 employees were transferred to the new Road and Bridge Maintenance contractors, 20 employees stayed with the government, a few resigned, and about 200 took early retirement. In 1995, companies owned by ex-government employees held 16 contracts and controlled 57% of the total value of all 28 contracts. (PBC Resource Guide, WB 2009)<sup>15</sup>.

74. In 1998 Transit New Zealand let the first 10-year performance-specified maintenance contract (PSMC). Under this contract the maintenance provider was responsible for maintaining the road network to meet a number of Key Performance Indicators (KPIs). Two years later, Transit NZ introduced a shorter version, so-called "hybrid" contracts, which incorporate features of conventional method-based and performance-specified maintenance procurement. These contracts typically run for a period of 5 years. By 2006 PSMCs were used on 15% of the entire road network of New Zealand, predominately on national roads, which are generally sealed. At least one contract includes a mix of national and regional roads, with both sealed and unsealed roads. Recently New Zealand introduced two new types of PBCs, the Maintenance Alliance Model (World Bank 2014 A) and the Operations and Maintenance Outcome Contract (OMOC)<sup>16</sup>

75. The PSMC consists of a 7 to 10-year contract for providing all the products or services associated with state highway network maintenance and management. In a similar way to the hybrid model, the PSMC model utilizes output-based contracting, relying on self-compliance by the supplier to ensure performance. It strives to maximize the skills, expertise, innovation and

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<sup>15</sup> For more information of the PBCs in Canada see: [http://www-esd.worldbank.org/pbc\\_resource\\_guide/Case-Canada.htm](http://www-esd.worldbank.org/pbc_resource_guide/Case-Canada.htm)

<sup>16</sup> <https://www.nzta.govt.nz>

systems of the road industry, expecting higher efficiency and improved value for money. The PSMC is a single lump-sum contract, which includes:

- Bringing the assets to the contracted standards, with a provision that changes in safety legislation (standards) become contractual;
- Provision of all inspections;
- Identification, programming, prioritization and delivery of maintenance services necessary to achieve specified performance criteria; and
- Management of the integrity of the assets using a cost effective long term maintenance strategy.

76. Payments are monthly and are independent of actual works and services provided, but may vary subject to meeting performance criteria (WB 2006)<sup>17</sup>

77. Under the *Hybrid Model*, the client advised the quantum of renewal and rehabilitation works to be completed on an Output basis, with all other maintenance activities to be completed on a lump sum basis for the outcome required. Contracts are typically 5 – 7 years in duration. Practically, the client retains the risk for the quantum of renewal works required while the contractor takes the risks associated with the quality of workmanship and the identification of the best location to undertake the works. A consultant is engaged to both monitor the performance of the contractor and to undertake the long term asset management planning activities (World Bank 2014 A).

78. Both the Hybrid Model and the PSMC will be gradually replaced by the new Maintenance Outcome Contract Model.

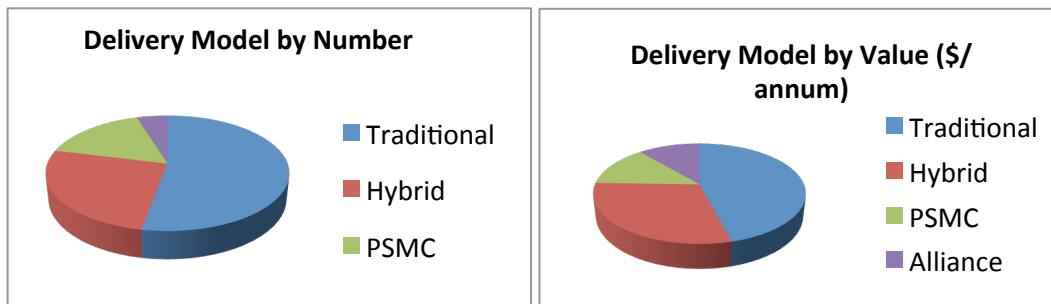
79. In an *Alliance Model*, the owner, contractor and consultant work as an integrated team to deliver specific activities under a contractual framework where their commercial interests are aligned with actual project outcomes. The key principle is that the Alliance assumes collective responsibility and takes collective ownership of all risks and opportunities, with an equitable share of the “pain” or “gain” of the project outcomes in comparison with the pre agreed targeted outturn costs. The Alliance Model uses a specific type of Cost Reimbursement method that seeks to drive the required best for project behaviour. The duration of contracts is between 7 and 10 years (NZ Transport Agency 2014).

80. Conventional Contracts are 3 to 5 years and range from input to output to outcome based and are used for specialist asset management activities like pavement repairs, emergency works, drainage, signage, delineators, litter control, vegetation control, pavement markings, bridge management, traffic counting and traffic operations centre. Figure 8 illustrates delivery modes for maintenance for each model by number and by value (\$/annum).

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<sup>17</sup> For more information on PBCs in New Zealand see: [http://www-esd.worldbank.org/pbc\\_resource\\_guide/Case-New%20Zealand.htm](http://www-esd.worldbank.org/pbc_resource_guide/Case-New%20Zealand.htm)

**Figure 7:** Contracts used for Network Maintenance Management in New Zealand



Source: NZ Transport Agency, State Highway Procurement Strategy 2014.

81. A review of the delivery models for PBCs in New Zealand is described in (OPUS 2012).
82. In December 1996 the **Virginia Department of Transportation (VDOT) in the USA** awarded to 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 was 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 was an independent company with two consulting firms as prime investors, which made an unsolicited offer to VDOT for this contract, sensing that this line of business was especially suited to consulting firms and was going to have a great future in the US, which it was. VDOT estimated that this contract saved approximately 16% over the 5.5-year contract period, this calculation based on the assumption that the highway is maintained to its pre-existing condition. In December 2000 VDOT issued a report showing that actual conditions improved - resulting in further real savings. In addition, VMS implemented a number of pavement material innovations, including Roadflex, Novachip, and a crack seal program that improved the service life of the interstate highways as well as a mobile patcher. With a "just-in-time" delivery of maintenance services the contractor engaged resources – labour, materials and equipment – on an as needed basis. This lowered total cost by avoiding excess inventory and underutilization of resources.
83. Under the contract, VMS was 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

84. Under the contract, VMS was also responsible for traffic control and assistance to the Virginia State Police and to local police and fire authorities. VMS' response time was 20 minutes during normal working hours and 40 minutes during non-working hours. After major incidents a critique of how good VMS responded and managed traffic control was performed. In addition, VDOT submitted questionnaires to all nine Virginia State Police units along the interstate corridors managed by VMS. Responses indicated that VMS' performance was highly appreciated.

85. In-house staff provided approximately 15% of VMS' services. The remaining services were 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. In this way, better quality could be provided at lower cost. (Lande 1999 and Author ). Since then, several other states in the US have implemented PBCs (Hymen 2009).

86. In the nineties, **Estonia** went through a privatization reform that also affected the road sector. The Estonian National Road Administration (ENRA) was encouraged to promote the creation of contracting firms and outsource road works to contractors. Private firms established at that time recruited mostly former government employees who were experienced in the execution of road works. In 1995 ENRA started a pilot experience of performance-based procurement of road management and maintenance. From 1995 through 2000, ENRA tested several one-year and two-year performance-based contracts (PBC Resource Guide, WB 2009). During the period from 2000 to 2005 several 5-year PBCs have been awarded and, starting in 2007, contract duration went to 7 years and, as of 2008, the entire road network administered by the ENRA of 16500 kilometres is maintained under PBCs. Estonia did not receive IFI loans to implement PBCs but did receive technical assistance from the Finnish Road Authority.

87. The scope covers routine and winter maintenance and minor emergency works on paved and unpaved roads. Resurfacing and rehabilitation works are not included. Performance monitoring comprised periodic informal and monthly formal inspections. While the informal inspections are performed by supervisors from the ENRA, the monthly formal inspections are undertaken by a Commission, which usually consists of 3 supervisors, 1 traffic person and 2 representatives from ENRA.

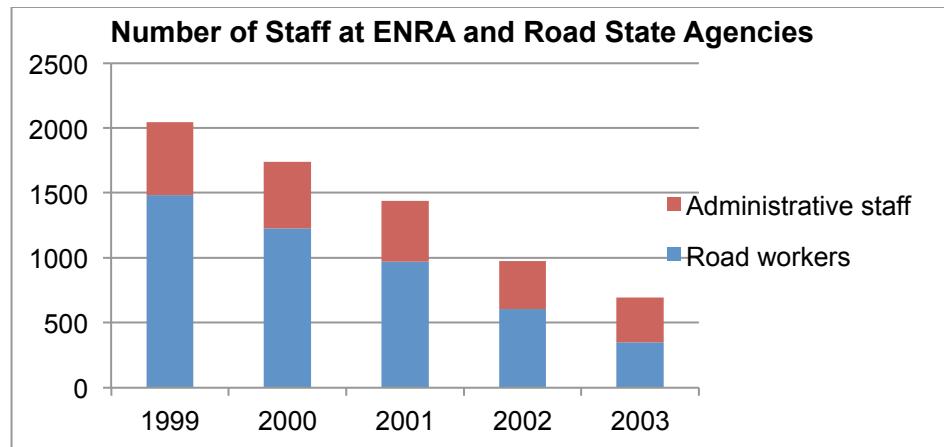
88. Road users are also encouraged to participate in monitoring and evaluation of the contractors' work. Billboards with contact information are established along the contracted road corridors to encourage reporting of any deficiencies. Since the deployment of a PBC approach, ENRA has noticed a decrease in the number of complaints from road users about road conditions. The winter road user surveys revealed that 50% of the polled road users considered the traffic conditions on main roads good or very good. This figure increased to 76% four years later<sup>18</sup>.

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<sup>18</sup> For more information on the subject ,see annual reports of the ENRA: <http://www.mnt.ee/?lang=en>  
Report are available in Russian language as well: <http://www.mnt.ee/?lang=ru>

89. Estonia went through a similar experience to British Columbia when changing from in-house road maintenance to road maintenance contracts and substantially reduced their labour force, of which many joined the PBC contractors, see Figure 9.

**Figure 8:** Workforce Reduction in the Estonian National Road Administration



Source: ENRA

90. One of the reasons for the workforce reduction was the outsourcing of routine maintenance works under PBCs, which led to the need for fewer workers to continue executing other kinds of road works and fewer administration staff to administer and supervise PBCs<sup>19</sup>

### 3.2 Developing and Transitional Countries

91. **Serbia and Montenegro** started two hybrid type pilot PBCs, which covered routine and winter maintenance as well as routine bridge maintenance. Many routine maintenance works were still paid on a unit price basis. Both contracts were of 3 year durations with a two-year extension, if the contractor performed well and agreed to continue. Actual duration was 3 years and 7 months due to lack of funds. The PBCs covered 660 km of regional roads in one district and 517 km of regional roads in the other district. The pilot projects were financed by the World Bank (91%) and the central government (9%).

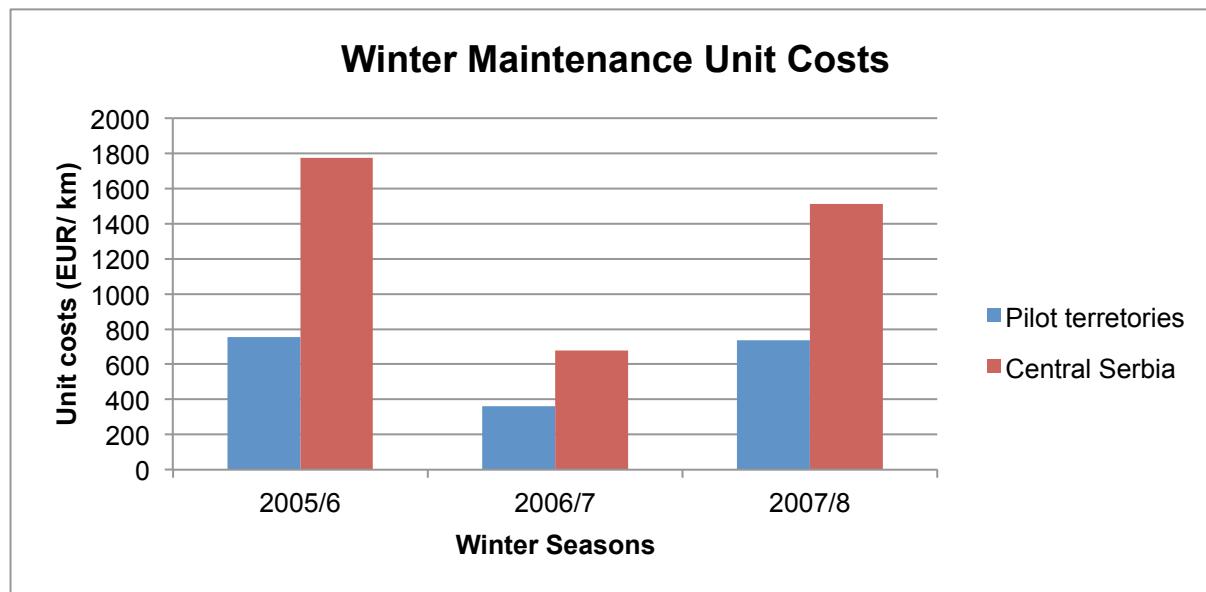
92. One international and five domestic contractors participated in the international tendering. One contract was **awarded** to the international contractor and the other to one of the domestic contractors. Supervision was outsourced to a local consulting firm since nobody in the road administration was willing to do the job, due to their low salaries.

<sup>19</sup> For more information on PBCs in Estonia, see [http://www-esd.worldbank.org/pbc\\_resource\\_guide/Case-Estonia.htm](http://www-esd.worldbank.org/pbc_resource_guide/Case-Estonia.htm)

93. The main challenge that the client and the contractors faced was the lack of sufficient qualified staff of the road administration, the consultants and the contractors. Training courses were held by the consulting firm that produced the bidding documents and assisted during the bidding process but they were considered insufficient. A coaching and training consultant, at least for the first two years of the contract, would have helped to solve this problem.

94. Nevertheless, both PBCs were considered successful, since they significantly improved the road conditions, reduced routine maintenance cost by an average of 49% and winter maintenance by an average of 52% compared with the central region of Serbia during the same period. The savings achieved for winter maintenance was due to the savings in salt and aggregates. Instead of applying the amount of salt and aggregate as specified in the technical rules, skid resistance was used as performance level (see Figure 10).<sup>20</sup>

**Figure 9:** Comparison of Winter Maintenance Unit Costs for the Pilot Projects against Costs from Central Serbia



Source: Radovic et al. 2014

95. Unfortunately, both pilot projects were discontinued before the envisaged 3 plus 2-year contract period ended due to lack of funds. For more information on the pilot projects, see (PBC Resource Guide, World Bank 2006)<sup>21</sup> and Output and Performance Based Road Maintenance Contracting – Case Study Serbia by Nebojša Radović, Katarina Mirković, Miloš Šešlija, Igor Peško, 2014<sup>22</sup>

<sup>20</sup> For more details on the winter maintenance performance levels used in Serbia and Montenegro see Bidding Document for Routine and Winter Maintenance -Specifications, see

[http://www-esd.worldbank.org/pbc\\_resource\\_guide/BiddingDocs.htm](http://www-esd.worldbank.org/pbc_resource_guide/BiddingDocs.htm)

<sup>21</sup> [http://www-esd.worldbank.org/pbc\\_resource\\_guide/Case-SerbiaMn.htm](http://www-esd.worldbank.org/pbc_resource_guide/Case-SerbiaMn.htm)

<sup>22</sup> [http://hrcak.srce.hr/index.php?show=clanak&id\\_clanak\\_jezik=182234&lang=en](http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=182234&lang=en)

96. Only recently, a new approach has been started by the World Bank to revive PBCs in Serbia and Montenegro.

97. As a consequence of the financial crisis in **Argentina** in 1990, the national road administration (DNV later DNH) let several concessions for a total of approximately 10000 km of the national road which carried enough traffic to justify road tolls. The concessionaire controlled axle loads by installing and operating weigh bridges. Since the contractors did not have the power of enforcement, they made agreements with the local police to assist.

98. In 1996, DNV started PBCs known as CREMA (in English: Road Rehabilitation and Maintenance Contracts). Originally the DNV wanted them to cover a contract period of ten years. Since they needed financing from the World Bank, the contract period was fixed at 5 years to suit the World Bank, which had no prior experience with such contracts. After some initial teething problems in project implementation a total of about 11000 km of the non-concessioned national roads carrying between 250 and 2500 vehicles per day were contracted out to the private sector. Later, in a second phase, another 8200 km of national roads were contracted under road rehabilitation and maintenance contracts. Today PBCs cover the entire national and part of the provincial road network of Argentina<sup>23</sup>.

99. Success factors mentioned by the Word Bank (World Bank 2006) include:

- delays in project implementation were minimized by the requirement for contractors to carry out detailed engineering designs before initiating the works. This enabled the Bank's funds to be disbursed rapidly;
- government supervision costs decreased substantially as contractors were required to perform their own quality control;
- lump-sum contracts practically eliminated cost overruns;
- by making the long-term payment obligation legally bidding on the government, the CREMA has established a mechanism that ensures Treasury provides funding for road maintenance. Experience during implementation showed that at times of fiscal constraints, (in 1998 and 1999 and at the end of 2001) the budget process respected the CREMA contracts and funds were allocated to them in priority, as if they were considered a non-discretionary expenditure;
- the performance levels have been simple enough to apply and monitor by a much-reduced inspection team consisting generally of one engineer and one laboratory technician, and the desired results have been obtained;
- the system has fostered innovation in the programming and execution of works, since payments are tied to outcomes and not to rigid specifications on materials standards or workmanship;
- the contractor's obligation to maintain the roads over a five-year period has reduced the risk of unsatisfactory quality in the rehabilitation and subsequent maintenance works.
- in terms of cost efficiency, the system has proven superior to the conventional unit price contracts. Ex post economic evaluation of the first generation of CREMAs showed that the rehabilitation and maintenance funding yields an economic rate of return of 60%, at a 12% cost of capital. The contracts did reduce the need for future capital investments by

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<sup>23</sup> [http://www-esd.worldbank.org/pbc\\_resource\\_guide/Case-Argentina.htm](http://www-esd.worldbank.org/pbc_resource_guide/Case-Argentina.htm)

nearly 30%. Competition during bidding, combined with the fact that only one of the 60 contracts was cancelled due to contractor financial difficulties, suggest that these contracts are financially attractive to the private sector. Comparing the unit costs of the CREMAS rehabilitation works to those achieved in the more conventional ad-measurement contracts, such as the ones used in the Provincial Roads Project, shows that the long-term performance-based system is, overall, more cost efficient.

100. In 1996, the Ministry of Public Works in **Uruguay** started its first pilot PBC on national roads initiated by a German Technical Assistance Program<sup>24</sup>. Two types of contracts were used; one covered routine maintenance only and the other one included initial rehabilitation and periodic and routine maintenance. The routine maintenance only contract was developed to give employees of the Ministry of Public Works an opportunity to form their own private enterprises, thus reducing Ministry staff numbers. To provide security, staff were given the opportunity to return to the ministry during the first year of the contract in case the contracting arrangement failed. No failures eventuated and consequently more staff wanted to form companies than new contracts could absorb. Contracts including initial rehabilitation and periodic and routine maintenance were also piloted with excellent results in a short time-period. Since actual road conditions were substantially below the contract performance standards, the contractor was given between 3 and 12 months to upgrade the different assets to the required standards.

101. 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, combined with strong commitment and support from the Minister of Public Works. Due to legal restrictions contract duration was limited to 4 years.

102. Also in 1996, Montevideo in **Uruguay** started the first performance based contract for 138km of its city roads. Deficiencies in parts of the road network required initial spot rehabilitation paid for on a unit price basis. The 3-year contract allowed for a 3-year extension, whereby the monthly fixed payments were reduced by 40% during this extension period<sup>25</sup>.

103. In 2001, the Public Works Department (PWD) of the Ministry of Works in **Malaysia** introduced performance based area contracts for the entire federal road network, except for the part managed under toll concessions. The main reason for introducing long term PBCs was to secure long term road maintenance financing.

104. The Malaysian peninsula was divided into 3 areas with one contract each. The length of the contracts extended over lengths of 3075 km, 4000 km and 7498 km, each with 15-year contract durations. The PBCs cover routine and periodic maintenance. Not all of the routine maintenance works are performance based, some of them are cycled works.

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<sup>24</sup> [www.zietlow.com](http://www.zietlow.com)

<sup>25</sup> For more information on the PBCs in Uruguay see presentation by Gunter Zietlow: [http://www-esd.worldbank.org/pbc\\_resource\\_guide/Docs-latest%20edition/cases-and-pdfs/5\\_PBC\\_Uruguay.pdf](http://www-esd.worldbank.org/pbc_resource_guide/Docs-latest%20edition/cases-and-pdfs/5_PBC_Uruguay.pdf)

105. Since 2014, the Public Works Department is in the process to prolong the PBCs for another 10 years, provided that the contractors will be able to present an offer where all routine maintenance is performance based and provides better value for money than the existing PBCs. The reason why Malaysia introduced long term PBCs was to ensure sufficient funding for road maintenance and to guarantee good road conditions. Both objectives have been fulfilled.

106. In 2003, the **Philippines** started three 3-year pilot PBCs under the National Roads Improvement and Management Program (NRIMP I). All projects included backlog maintenance, routine and periodic maintenance with a length of 112, 109 and 33 kilometres respectively. Only routine maintenance was paid on a lump sum basis. The contracts were undertaken by foreign contractors and supervised by staff of the Department of Public Works and Highways (DPWH). All the PBCs achieved their objectives but success was hampered by:

- the fact that the PBC concept was new to the contractors and DPWH. Neither the contractor or DPWH staff understood the PBC concept, nor did they receive training or coaching on how to manage the contracts;
- little information was provided to the potential contractors on the history and actual condition of the road, exposing the contractors to unreasonable risks that might have contributed to higher cost estimates. In addition, pumping problems<sup>26</sup> in one contract should have been detected by the client at an earlier stage. If historical data of this road section had been available, this problem would certainly have been detected earlier;
- monthly formal inspection of defects was made jointly by the contractor and the client on the total length of the roads under contract and formed the basis for determining the starting date of the response times only. Therefore, there was no incentive for the contractor to act proactively;
- there was persistent concern that penalties were not being rigorously enforced. In addition, the amount of penalties was rather low;
- the short duration of the contracts, where the routine maintenance components represented only 14% of the contract prices.

107. Since 2014 longer term PBCs are being implemented under NRIMP II. The scope includes backlog elimination, routine and periodic maintenance and rehabilitation works.

108. **More country case studies** can be retrieved from the PBC Resource Guide of the World Bank 2006<sup>27</sup> for Australia, Brazil, Chad, Denmark, Finland, Peru, South Africa, UK and USA.

109. In addition, the World Bank Transport Paper TP 42 A, March 2014<sup>28</sup>, reviewed PBCs in Argentina, Brazil, Chad, Nigeria, Tanzania, Liberia, Zambia, India, Philippines, Egypt, Poland, Australia and New Zealand. Some of the important conclusions of the study are:

- very few PBCs failed once implemented;

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<sup>26</sup> Water was getting through the pavement from below due to drainage problems

<sup>27</sup> [http://www-esd.worldbank.org/pbc\\_resource\\_guide/Case-Studies.htm](http://www-esd.worldbank.org/pbc_resource_guide/Case-Studies.htm)

<sup>28</sup> Review of Performance Based Contracting in the Road Sector- Phase 1 by Theuns Henning and Ian Greenwood. See:

<https://openknowledge.worldbank.org/bitstream/handle/10986/18649/878280NWP0TP4200Box377314B00PUBLIC0.pdf?sequence=1>

- some PBCs failed to get implemented;
- to make it through the full PBC process, the project requires strong champions in the Road Organization and the Ministry of Finance;
- PBCs offer a procurement model that is more resistant to corruption than conventional contracts because of fewer transactions involved and transparent easier auditing.

110. Two more papers covering the experiences of implementing PBCs are: International Overview of Innovative Contracting Practices for Roads (Pakkala 2007) and *Performance-Based Contracting for Maintenance – A Synthesis of Highway practices*. (Hymen, W. 2009).

### **3.3 CAREC Countries**

111. **Afghanistan** started its first pilot PBC in 2006 on 142 kilometres of a newly reconstructed road between Kabul and Jalalabad, funded completely by the EU. The contract duration was 3 years and the scope included traffic management, routine and winter maintenance, repair and emergency works. Routine and winter maintenance was paid on a lump sum basis. All other works were paid on a unit price basis. Snow clearing was part of emergency works and paid on a unit price basis. The operation of two weigh stations, one in Kabul and one in Jalalabad, was part of the PBC.

112. Although there was no history of road maintenance contracting, 5 local contractors participated in the local bidding, of which 3 were responsive. Supervision was done by Ministry of Public Works (MoPW) staff, who received training at the start of the project<sup>29</sup>.

113. From 2008 to 2011 road rehabilitation and maintenance works were performed under two USAID funded Programs<sup>30</sup>. In total 1877 kilometres of National Highway, Secondary and Provincial roads were rehabilitated and maintained by a foreign management contractor. The contractor developed performance based road maintenance contracts that were appropriate for Afghanistan and which gave due consideration to the technical and contracting capabilities of Afghan road contractors and the prevailing security conditions.

114. A relatively independent Road Maintenance Unit (RMU) was established within the MoPW to plan annual work programs, prepare and award performance based road maintenance contracts and manage the maintenance of the USAID funded roads. The PBCs included routine road maintenance and emergency repairs.

115. During the first year, works contracts were let for six months with two month extensions. Subsequently 1500 kilometres of roads were divided into 5 packages and awarded to Afghan subcontractors. Training activities started in 2008 with RMU and MoPW staff followed by

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<sup>29</sup> Case Study Afghanistan, Kabul – Jalalabad Road Maintenance, Graham Williams, Arusha, February 2008

<sup>30</sup> Rehabilitation of Economic Facilities and Services Program and Afghanistan Infrastructure and Rehabilitation Program

private sector sub-contractors. While the performance of the Afghan subcontractors was mixed, the RMU was dissolved after the program ended in 2011<sup>31</sup>.

116. The implementation of PBCs in Afghanistan is still not sustainable and requires a holistic approach to secure long term financing, an appropriate institutional framework and a human resource development program.

117. In 2004 **Hong Kong** started its first Road Maintenance Term Contracts which contain some elements of PBCs with 4 year durations. Gradually the number of contracts increased with durations up to 8 years. The scope includes all works and services typically required to maintain an urban road network. Except for minor maintenance works, payments are made on unit prices and are based on work orders from the Highway Department. Payments are reduced when contractors do not comply with performance levels, referring to management issues, response times (after receiving orders from the Engineer), and/or works not complying with standards.

118. Contractors operate an electronic Maintenance Management System which facilitates the planning, programming, inventory data collection, maintenance history recording, data storage, complaint handling, management reports and retrieval of all aspects of the maintenance, inspection, remedial and repair works records. Payment reductions are made for non-compliance with performance levels<sup>32</sup>.

119. The main objective of the implementation of Road Maintenance Term Contracts was to execute road works more efficiently. In the absence of a base line survey, it was not possible to establish whether or not the contracts provide better value for money.

120. Since June 2013, the Government of **Tajikistan** is financing two 3-year pilot PBCs through its regular road maintenance budget, one for 73 kilometres and the other for 76 kilometres of national roads. ADB assisted project preparation. The scope includes routine and winter maintenance, repair works and emergency works. The repair works to bring the road asset up to the required performance levels are 31% and 16.4% respectively of the contract price for the two contracts.

121. Unit costs for the routine maintenance of the contracts, expressed in USD are shown in Table 6 below. These costs are slightly higher than routine maintenance costs in countries

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<sup>31</sup> Final Report, Road Operation and Maintenance Program – Final Performance Evaluation, June 12, 2012  
[http://pdf.usaid.gov/pdf\\_docs/pdacu415.pdf](http://pdf.usaid.gov/pdf_docs/pdacu415.pdf)

<sup>32</sup> For more information, see: [http://www.carecprogram.org/uploads/events/2012/PBMC-Training/008\\_102\\_209\\_Overview-Road-Maintenance-Issues-Hong-Kong-China.pdf](http://www.carecprogram.org/uploads/events/2012/PBMC-Training/008_102_209_Overview-Road-Maintenance-Issues-Hong-Kong-China.pdf). and Audit Report Road Maintenance, Department of Highways Hong Kong, Audit Commission Hong Kong 2011,  
[http://www.aud.gov.hk/pdf\\_e/e57ch05.pdf](http://www.aud.gov.hk/pdf_e/e57ch05.pdf) and Overview of Road Maintenance Issues in Hong Kong China;[http://www.carecprogram.org/uploads/events/2012/PBMC-Training/008\\_102\\_209\\_Overview-Road-Maintenance-Issues-Hong-Kong-China.pdf](http://www.carecprogram.org/uploads/events/2012/PBMC-Training/008_102_209_Overview-Road-Maintenance-Issues-Hong-Kong-China.pdf)

exhibiting similar characteristics, especially considering that winter maintenance costs are excluded. Factors that may contribute to higher routine maintenance costs are:

- penalties not being properly assessed;
- the cost of performing deferred maintenance to bring the road to a condition in which service levels are met;
- lack of a cost escalation clause in the contract;
- unfamiliarity with PBM contracting on the part of the local contracting industry causing them to not participate in the bidding or to allocate a cost for perceived risk.

**Table 6:** Annual Routine Maintenance Cost (\$) per kilometre

Lot 1 Nurobod to Nimich			Lot 2 Vhadat to Obi Garm		
Expenditure to Date	Length Km	Annual Cost per Km	Expenditure to Date	Length Km	Annual Cost per Km
341,871	73	2,342	347,067	76	2,283

Source: ADB 2015

122. Road conditions improved substantially during contract execution. Road users interviewed were satisfied, especially with the quality of winter services. Table 7 illustrates the performance rating at the beginning of the contract in July 2013 and in July 2015.

**Table 7:** Performance Monitoring Compliance Rating

PBM Contract	Compliance Rating	
	First month of Contract	July 2015
Lot 1 Nurobod – Nimich	79.95	97.95
Lot 2 Vhadat - Obi Garm	76.66	92.05

Source: ADB 2015

123. Most of the non-compliances reported were on service levels: Cracks wider than 3 mm, centreline visibility from 100 m and vegetation height < 0.5 m. For more information on the PBCs in Tajikistan refer to ADB 2015.

## 4. Lessons Learned

124. PBCs have become a well-accepted and established form of managing and maintaining roads worldwide and are gradually replacing the conventional way of contracting. Countries across the world have realized that PBCs:

- ***deliver good value for money.*** By changing from conventional road maintenance contracts, savings of between 20% and 30% have been achieved based on the same level of service. Good competition between well qualified and innovative contractors, long-term contracts, and a balancing of risks between the client and contractors are the main drivers for cost savings. Where these conditions are not met PBCs might not produce savings and may even result in higher prices compared to conventional contracts.
- ***provide better guarantee of sufficient funding for road maintenance.*** Since in almost all developing countries road maintenance is heavily underfinanced, medium and long term PBCs can help to solve this problem. Good examples are Malaysia, Argentina and Uruguay.
- ***improve road conditions, help to reduce road user cost and improve road safety.*** All PBCs have resulted in better road conditions on the roads under contract and have consequently reduced the risk of accidents and contributed to shorter travel times and reduction in vehicle operating cost.
- ***help to save substantial amounts of road rehabilitation and reconstruction work.*** As a rule of thumb: 1 USD spent in time on routine maintenance will save 3 USD on necessary rehabilitation or reconstruction works later on in constant prices.
- ***provide better expenditure certainty for the road agencies.*** Contractors are generally paid fixed monthly installments throughout the contract period and variation orders are minimized or even excluded.
- ***help to reduce complaints from road users about road conditions.*** PBCs provide predictable good and stable road conditions and help to increase the willingness of road users to pay for road use.

125. Many lessons on PBCs have been learned worldwide during the last 25 years. This report concentrates on lessons learned in developing and transitional countries, as they are considered most relevant to supporting implementation of PBCs in CAREC countries.

126. First, PBCs need a conducive environment for successful implementation. The most important factors are:

- strong commitment and support by key decision makers, especially from the Ministry of Finance, the ministry in charge of roads and the road organization;
- a positive attitude from Road Organization staff;
- well qualified staff of the client, contractors and consultants to plan and manage this new kind of contract;
- adequate road asset management system to support the requirements of PBCs.

- long-term funding, and
- a competitive market.

127. Second, **the best way to implement PBCs is to take a gradual approach** cognizant of the level of experience of all market stakeholders. With greater experience and confidence, the scope, complexity and duration of contracts can be increased. Pilot projects help to test the feasibility of PBCs and contribute to gaining experience.

128. Third, **risks shall be taken by the party who can best manage the risk.** Burdening the contractor with risks he cannot quantify or mitigate can lead to high prices, or even to premature termination of the contract.

129. Fourth, **pilot projects need careful preparation and need to be tailored to the specific conditions in each country.** A detailed road condition survey, realistic cost estimates, and well-designed bidding documents contribute to successful implementation of PBCs.

130. Fifth, **good supervision has turned out to be a crucial factor for success**, especially in developing and transitional countries.

131. Sixth, **pilot PBCs need coaching and training**, at least during the initial phase, until all parties involved are sufficiently familiar with the new concept. Since PBCs need a change in mind set, the time it takes to fully grasp the concept should not be underestimated.

132. Seventh, **hardly any PBCs initiated by an IFI has failed once implemented**, but a few failed to get implemented for various reasons, such as lack of interest by the road organization or lack of competition.

133. Eighth, **PBCs have offered a procurement model that is more resistant to corruption** than conventional contracts because of fewer transactions involved and transparent easier auditing.

## **5. PBC Implementation Strategy in CAREC countries**

134. Based on the broad lessons learned from PBC implementation across the world, this section discusses how PBCs can most effectively be rolled out in CAREC countries.

### **5.1 Create an Enabling Environment and meet Preconditions**

135. The successful and sustainable implementation of PBCs requires an enabling environment with several preconditions including (i) an effective and efficient institutional and regulatory framework; (ii) sufficient road maintenance funding; and (iii) well qualified road maintenance contractors in a competitive market.

136. Most CAREC countries have large scope to improve efficiency of their road sector institutions, improve the sufficiency of funds assigned to road maintenance, contract out maintenance as opposed to performing such functions in-house, and reduce overloading of vehicles. These pose special challenges for the implementation of PBCs and need to be addressed as part of a wider strategy on road asset management. As conditions are different in each CAREC member country, tailor made solutions are required.

137. Nevertheless, there are common methods on how to approach these problems. The first step would be to raise awareness amongst decision makers of the ineffectiveness and inefficiencies of the road sector, especially regarding road maintenance and the negative effects to the national economy. This could be done by a road sector study analysing the institutional, regulatory, financial and technical framework and other bottlenecks that impede the effectiveness and efficiency of road maintenance and develop a road map to address these issues. In this context, an analysis is required to determine how the introduction of PBCs can contribute to create more value for money.

138. In addition, a strategy on how to implement PBCs in the medium and long term needs definition. The conclusions need dissemination at the highest political level, especially at the cabinet level to clearly demonstrate the economic losses caused by the present road sector policies, and what needs be done to improve the situation with special emphasis on PBCs. In addition, the concept of PBCs needs to be explained to other stakeholders. This can be done best through presentations, seminars and workshops for key decision makers, road agencies, contractors, consultants and other interested parties. It is important to highlight the potential benefits of PBCs for each group of stakeholders.

139. Discussions with road agencies of other countries that have successfully implemented PBCs may help to form a better understanding and to avoid making mistakes when implementing PBCs. Study tours for key decision makers to such countries may help in securing high level support for the new contracts scheme.

140. Probably the most important issue is to secure sufficient funding for road maintenance, not only for one or several pilot projects, but for the long term. Once started with PBCs, roads

need to remain under PBCs to guarantee minimum performance levels in the future. In all CAREC countries, road maintenance is severely underfinanced. This is especially true when road maintenance is financed through the ordinary budget. Road funds or better road maintenance funds may help to ease the problem, but even the existence of a road maintenance fund does not necessarily guarantee sufficient funding for road maintenance. To reach a sustainable level of road maintenance financing, a fundamental shift in policy is required. This fundamental shift is required from governments and need to be supported by IFIs.<sup>33</sup>

141. The institutional framework needs to be conducive to implementing PBCs. Separating the planning and management of roads, from implementation of road works, and contracting out implementation to the private sector, is a prerequisite to start PBCs.

142. For PBCs to be successful, a strong commitment is required at the highest level of the organization. Individuals at mid-level also need to champion the PBC process. Road organizations who still execute routine road maintenance with their own labour force will have to start contracting out this work to the private sector, or at least have a strong commitment towards privatization of road maintenance before embarking on the first PBC pilot project.

143. Existing laws and regulations need to allow for short and long term PBCs and for multi-annual financing. If supporting legislation is not in place, laws and regulations need to be changed first. The same applies to road regulations and technical rules if they are not consistent with the PBC concept.

144. Overloading of vehicles severely shortens the life of pavements and seems to be a major concern in all CAREC countries. Even if the respective laws and regulations are in place, fines are normally too low and enforcement is almost non-existent. Effective enforcement of axle load limits can substantially reduce road maintenance costs. More effort is therefore needed to control overloading. If overloading remains a problem, overloading needs consideration when designing PBCs - either by price adjustment formula for overloading beyond an expected range, or by allowing the contractor to control overloading.<sup>34</sup> The best way to stop overloading is to increase fines to discouraging levels, or to physically stop overloaded vehicles continuing their journeys. If possible, the contractor should be put in charge of axle load control, which would require police support for effective enforcement.

145. For road agencies with experience contracting out routine road maintenance to the private sector, the next step to implement PBCs is relatively small. Road agencies need to create a special PBC unit within the organization with sufficient and qualified staff. A shortage of qualified staff, as may be the case in many CAREC countries, might pose a serious problem. Staff qualifications and experience can be improved through training and coaching to properly

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<sup>33</sup> See section 5.6: Role of International Financial Institutions

<sup>34</sup> There are several developing countries who have allowed contractors to control overloaded vehicles by fixed weigh stations and/or portable weigh scales.

prepare, supervise and monitor PBCs. For pilot projects this task might be undertaken by a qualified consultant.

146. For the successful and sustainable implementation of PBCs, a well-qualified contracting and consulting industry is vital. In many CAREC countries, the capacity of the contracting and consulting industry to implement PBCs is very limited too non-existent. It is also important to acknowledge that effective competition is required to keep costs low. Short-term and long-term measures will have to be taken to develop both the contracting and the consulting industry to face the new challenges.

147. An assessment of the capacity of the road organisation, contractors, including subcontractors, as well as consultants to implement PBCs, needs to be undertaken to identify deficiencies and to define what can be done to overcome them. The assessment will have a major impact on the design of the pilot PBCs. A methodology on how to assess these capacities is illustrated in Appendix 2.

## **5.2 Design a PBC Well**

148. Designing a PBC well requires (i) technical studies covering the selection of candidate roads, determining the scope of works and services and the duration of the contract, undertaking a detailed road assets condition survey, determining the right mix between unit rates, lump sums and performance based works and services with adequate performance levels, estimation of the likely cost, and a risk assessment and mitigation strategy; (ii) design of tender documents; (iii) data to be supplied to tenderers; and (iv) appropriate supervision arrangements.

### **149. *Technical studies.***

150. Select candidate roads. The most important selection criteria are the road conditions, importance of the road and ease of access for contractors. Other factors that may be taken into consideration are shown in Table 8.

**Table 8:** Site Selection Criteria for Pilot site in Indonesia

Criteria	Importance
Maintain local competition	High
Capacity of local industry	Very High
The size of the contract that the local industry can handle	High
Risks are not significantly higher than elsewhere on the network	High
No significant events that may affect the future management of the road	Very High
Knowledge of PBC concepts and desire to make PBC work by local DGH staff	Very High
Operational asset understanding	Very High
Historical maintenance cost data	Medium
Robust Asset Data	Very High
Reliability of traffic loading forecasts.	High
Availability of resources to all contractors.	High
Value of initial improvement works	High
Location of weigh bridges	Very High

Source: Greenwood, I. et al. 2005

151. Determine the duration of contract. The duration of the contract is influenced by the available funds, scope of the contract and the qualification of contractors. Contracts covering routine maintenance only can be shorter than contracts with substantial amounts of capital works, see PBC options in Chapter 6. The better the qualification of a contractor, especially regarding their ability to forecast pavement deterioration patterns, the longer could be the contract duration.

152. Carry out detailed condition surveys. Detailed road condition surveys are required to estimate the likely cost of the contract. Since roads often tend to deteriorate rapidly, surveys might need to be updated if there are major delays in contract award. The road surveys shall be made available to the tenderers below.

153. Determine the mix between unit rates, lump sums and performance based works and services. This mix mainly depends on the qualifications of the contractor. The better qualified the contractor the more works and services can be paid performance based.

154. Determine adequate performance levels. There are two types of performance levels: Management and Operational Performance Levels. Management Performance Levels need to make sure that the contract is adequately managed by the contractor and allows the road organization to monitor the PBC effectively. Operational Performance Levels mainly depend on existing technical regulations, affordability, traffic volumes, scope of works and services, measurability and whether they fulfil the objectives mentioned in paragraph 49 above.

155. Estimate the likely cost. Based on the road asset conditions, estimates of the works will have to be made to bring the road asset conditions to the required performance levels. In addition, a projection of the deterioration of the road assets over the contract period will have to

be made and an indicative work program, including any required additional works, needs to be established to estimate the likely cost of the PBC. Making the cost estimate available to tenderers (with little or no PBC experience) may serve as a valuable market guideline for their own determination of their tender pricing.

156. Risk assessment and mitigation. Refer to Point 2.5 Risk and Mitigation above.

157. **Design of tender documents.** There is a wide variety of tender documents for PBCs available on the World Wide Web<sup>35</sup>. Each country is using its own format and develops it further based on past experience. CAREC countries may use the Sample Bidding Documents – Procurement of Works and Services under Output and Performance Based Road Contracts and Sample Specifications, World Bank 2006<sup>36</sup>. These sample bidding documents would need to be adapted to the specific conditions in each country. Another option is to use the recently published contract template for road maintenance services of the Department of Transport in the UK (Department of Transport 2015). For the PBC under option 1 (see Point 6.1 below) the ADB contract template for small works might be used and adapted to the requirements of PBC.

158. There are several issues that should be given special consideration when designing tender documents for PBCs: Performance levels, payment and incentive systems, performance monitoring and risks and risk mitigation have been discussed under Point 2 above. Other important issues are the management services, data collection and management, cost escalation clause, traffic volume and overloading adjustment clause, utility services, payment guarantees / bond requirements and interest payments for late payment by the client.

159. Management services are more complex than in a conventional contract and include a Program of Performance, which is detailed in Appendix 5. The Contractor shall establish and maintain, within his own organizational structure, a Performance Management Unit staffed with qualified personnel, whose task is to monitor and verify continuously the degree of compliance by the Contractor with the Service Levels. The Performance Management Unit shall also ensure the quality control, inspection and testing required for all works and services during the contract period. The Performance Management Unit shall maintain at all times a detailed and complete knowledge of the condition of the road and related assets included in the Contract. It also needs to provide the Contractor with all the information needed to manage and maintain the road and related assets in accordance with the Performance or Service Levels. The roles and responsibilities of the Performance Management Unit shall be clearly described in the Contractor's Programme of Performance.

160. Data collection and management is mainly shifted to the contractor and the road organisation needs to make sure that the data will be collected by the contractor to a predefined standard and turned over to the road organisation. Proper procedures have to be included in the contract for collecting and managing data by the contractor.

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<sup>35</sup> Appendix 4 provides a selection of tender documents used in various countries

<sup>36</sup> [https://www.google.de/?gws\\_rd=ssl#q=sample+bidding+documents+oprc+world+bank](https://www.google.de/?gws_rd=ssl#q=sample+bidding+documents+oprc+world+bank)

161. Cost escalation clause. Since PBCs are longer term contracts, prices will change over time and will have an influence on the actual cost to the contractor. Therefore, a cost escalation clause needs to be developed reflecting the different inputs, which will be required over the contract period. Price adjustments should be done once a year or more frequently for countries with high inflation.

162. Traffic volume and overloading adjustment clause. Traffic volume and composition as well as axle loads have a major influence on pavement deterioration. Traffic volume and composition and axle loads need to be forecasted over the contract period. If it can be expected that the actual figures may substantially deviate from the forecast, a price adjustment is recommended to reduce the risk to the contractor.

163. Utilities within the road reserve. Although maintenance of utilities is not to be included in the PBC, the contractor should be made responsible if they damage any utilities. Contractors shall however be given the right to approve backfill quality and compaction by others, since poor backfill quality and compaction may require the PBC contractor to make good the repair by others to maintain the PBC performance levels.

164. Interest on late payment by client. Late payments by clients cause additional cost to the contractor. Therefore, it is suggested to apply an interest charge to the late payment, based on the standard international borrowing rate, such as LIBOR.

165. Bond requirements. A two-stage performance bond is recommended; the first stage to cover the initial works and the second one for the maintenance period. The bond amount shall be sufficient to cover any outstanding capital works, any maintenance works to bring the assets up to the required performance levels and the cost of re-tendering in the event of the contractor defaulting or contract termination due to non-performance of the contractor.

166. **Data to be supplied to tenderers.** The following data refer to maintenance activities only. Data to be supplied to tenderers for other road works are no different to data needs for traditional civil work contracts.

- Description of project area,
- Detailed list of roads and road sections and right of way,
- Traffic volume and composition during the last 5 years,
- Axle load measurements during the last five years, if available,
- Rainfall quantities and pattern,
- Temperature pattern,
- Snow fall pattern for the last 5 years,
- Technical information on each road, section such as construction data, previous works executed,
- Maintenance history, if available,
- Annual routine maintenance expenditures during the last five years per kilometer,
- Annual expenditures for winter services,

- Road asset inventory,
- Road condition data, inclusive of deflection, roughness, skid resistance, rutting.
- Noncommittal indicative work program over the contract period, and
- Noncommittal cost estimates

167. **Supervision arrangements.** There are two possibilities; either supervision is done by the client or by a consultant. If the supervision is done by a client that does not have experiences in PBCs, it is recommended to employ a qualified coaching and training consultant, which can coach and train the staff of the client as well as the contractor in managing and monitoring the PBC. It is further recommended to include in any consulting contract performance levels and payment reductions for non-compliance with performance levels. Consultancy contracts shall also include management service levels with payment reductions for non-compliance. Terms of reference for consultancy contracts can be found on the website of the World Bank, see [http://www-esd.worldbank.org/pbc\\_resource\\_guide/TOR.htm](http://www-esd.worldbank.org/pbc_resource_guide/TOR.htm).

### 5.3. Procure a PBC Well

168. Procurement covers (i) pre-qualification of contractors; (ii) organization of pre-bid seminars for prequalified contractors; (iii) answering queries and issuing addendums; (iv) evaluation of bids; (v) award of contract; (vi) preparation of tender documents for supervision and/or coaching and training consultants; (vii) preparation of qualification criteria for supervision consultants; (viii) preparation of qualification criteria for coaching and training consultants; and (ix) award of supervision or coaching and training contract.

169. **Pre-qualification of contractors.** The objective of pre-qualification is to make sure that only sufficiently qualified tenderers will proceed to the full tendering process. This will minimize the cost associated with tender preparation for the industry, and to the client for tender evaluation. The pre-qualification criteria for contractors would be different depending upon the market characteristics, and the complexity of the PBC. If it can be expected that more than 5 contractors will tender, and there is doubt as to their ability/capacity to undertake the work, pre-qualification is advised. Sample prequalification criteria are provided below. (Greenwood, I. et al. 2005):

- Company financial statement and insurance details;
- Track record and relevant experience;
- Summary of staff with specific skills and experience relevant to the scope of services;
- Contractor's ability to demonstrate the implementation of innovative practices.
- Details of intended partners and subcontractor/consultant proposed for the project; and
- ISO 9001<sup>37</sup> or 9002 certifications.

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<sup>37</sup> ISO 9001 “Quality Management System – Requirements” requires contractor to establish, document, implement, and maintain a QMS that: Identifies processes, illustrates sequences and interactions, identifies criteria and methods to ensure effectiveness, documents resources and information necessary to operate, monitor, measure and analyze the processes and defines action required to achieve the planned results and continually improve the process

170. If a PBC consultant is to be employed, candidates should submit the following information:

- Professional registration;
- Track record and relevant experience;
- Summary of staff with specific skills and experience for geometric and pavement design, pavement investigation and maintenance planning, pavement management system, construction and, rehabilitation supervision, and reporting against performance criteria; and
- ISO 9001 certification or equivalent.

171. In the event where there is a lack of competition, the threshold for prequalification might need to be set low to attract participation. To compensate for the lack of qualifications training courses might be considered to improve qualifications before going to the full tender stage. The other option is to provide more intensive coaching and training during the contract period.

172. **Organization of pre-bid seminars for prequalified contractors.** When contractors are not sufficiently experienced with PBCs, pre-bid seminars, including site visits, are very important to make contractors familiar with the demands of the contract requirements. One or two day seminars have often not been enough to achieve this goal. Therefore 3 to 4 days are advised.

173. **Answering queries and issuing addendums.** This follows the normal procedures for civil works contracts.

174. **Evaluation of bids.** Besides the normal requirements for civil contracts, PBCs require additional management and technical qualifications. The exact qualifications needed depend on the scope of the PBC. Nevertheless, some qualifications and experience which are required for all PBCs including:

- 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. This includes (a) sufficient experiences in road maintenance and winter services (where required). If the contractor does not have the necessary experience/expertise, he may want to employ staff of the road organization. This eventuality needs to be covered within the tender documents to put all tenderers on an equal basis, (b) the capability of predicting the deterioration pattern of pavements. If this expertise is not available in-house it would need be acquired through subcontracting a qualified consultant. This qualification is less important for contracts with shorter durations.
- Sufficient qualified staff. The contractor must detail the experiences of the following key personnel in Table 9:

**Table 9:** Qualifications of Key Personnel

Key Personnel	Summary of Functions
<b>Road Manager</b>	A person appointed by the Contractor who is in charge of managing all activities of the Contractor under the Contract. The Road Manager is the Contractor's Representative for Contract purposes.
<b>Operations Manager</b>	Responsible for planning, coordination and execution of all road maintenance operations and winter service, if required.
<b>Performance Manager</b>	Responsible for the management of the Performance Management Unit and for the development and maintenance of the Program of Performance
<b>Chief Engineer</b>	Responsible for all technical and engineering duties connected with the Contract.
<b>Systems Manager</b>	Overall contractor responsibility for telecommunications, hardware, software, MIS system administration and MPC operations, data entry, maintenance of information, Help desk, MIS training, MIS Service Levels and MIS backup & recovery.

Source: Author.

- A quality management system in accordance with ISO 9001 or equivalent and a Quality Assurance Plan for the execution of the contract detailing how to:
  - identify the quality requirements, especially the performance levels, specific to the contract,
  - plan and execute the works to satisfy those requirements,
  - inspect and/or test the works to ensure compliance with the quality requirements,
  - record and monitor the results as evidence of compliance, and
  - ensure the prompt actions taken to correct non-compliances.
- An Emergency Procedures and Contingency Plan to ensure safety of the contractor's personnel and road users in the case of emergency and/road closure. It should include:
  - an effective communication and event recording system,
  - the name, contact number and specific duties of the contractor's personnel nominated to respond to an emergency event,
  - the contact number of other parties who need to be notified in cases of emergencies,
  - detailed response procedures for all emergency events, and
  - possible detour routes in the event of road closures.
- A Traffic Management Plan, and
- A Health and Safety Management Plan.

175. Two stage bidding may be appropriate to guarantee a minimum qualification. In the second stage it might be considered to evaluate bids not only on the price but on management and technical experiences as well as. PBC tenderers must have sufficient experience in road

maintenance and winter services (where required). Example evaluation criteria and weightings are illustrated in Table 10.

**Table 10:** Evaluation Criteria and Weights Applied for the Award of the Performance Contract in Washington D.C.

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%

Source: Zietlow 2004

176. **Award of contract.** Follows the usual procedure for civil works contracts.

177. **Preparation of tender documents for supervision and/or coaching and training consultants.** As stated above, it is recommended to include performance levels in such contracts as well, including payment reductions for non-compliance. Terms of reference for such contracts can be found on the website of the World Bank, see [http://www-esd.worldbank.org/pbc\\_resource\\_guide/TOR.htm](http://www-esd.worldbank.org/pbc_resource_guide/TOR.htm).

178. **Qualification criteria for supervision consultants:** The supervision consultant shall submit the following information (Greenwood, I. et al. 2005):

- Professional registration;
- Track record and relevant experience;
- Summary of staff with specific skills and experiences for geometric and pavement design, pavement investigation and maintenance planning, pavement management system, construction and, rehabilitation supervision, reporting against performance criteria and PBC contract development and tendering process.
- ISO 9001 certification or equivalent.
- At least 5 years' experiences in the supervision of PBCs

179. **Qualification criteria for coaching and training consultants.** Follows the qualification criteria for supervision consultants, but would require at least 5 years' experiences in coaching and training of PBC clients and contractors.

180. **Award supervision or coaching and training contract.** Follows the usual procedure for consultancy contracts.

#### **5.4 Implement a PBC Well**

181. Implementing PBCs well requires (i) coaching and training; and (ii) monitoring and evaluation.

182. **Coaching and training.** Coaching and training by an experienced consultant helps the client, contractor and subcontractors to better manage and monitor the PBC. Engaging a coaching and training consultant is strongly recommended, especially during the first year of implementation, with regular inputs to reinforce learning over periodic visits. The scope and intensity of coaching and training depends on the qualifications of the staff of the road organization, contractor and subcontractors. A PBC operational handbook should be developed reflecting the specific needs of the pilot project, especially for the supervision and monitoring of the performance levels. There are some training programs available on the internet, but the main emphasis shall be on-the-job training.

183. **Monitoring and evaluation.** A PBC unit with qualified staff needs to be established within the road organization to monitor the pilot PBC and to design and implement further development of PBCs in the country. Experience has shown that enforcement of payment reductions is often not strictly adhered to. It is strongly recommended to enforce compliance with service levels from the start of the project. Compliance with service levels is the key characteristic of PBCs and must be assigned due importance. Monitoring and evaluation is particularly important for pilot projects. A monitoring and evaluation approach should focus on how well the PBCs is fulfilling its objectives, and offer real time feedback that can be used to improve implementation.

## 6. Recommended Options for Pilot PBCs in CAREC Member Countries

184. This chapter recommends three practical options for implementing pilot PBCs in CAREC member countries. The different options can be tailored to prevailing road conditions and cover the chosen scope of works and services, payment options, service levels, delivery mode, and supervision arrangements. For each option the advantages and disadvantages are discussed. In addition, recommendations are made to what options of pilot PBCs are less recommended in some CAREC countries at this stage.

### 6.1 Option 1: Routine Maintenance, 3-4 Years, 100-150km

185. This option refers to PBC for routine maintenance including winter services (where applicable) for 3 to 4 years covering between 100 and 150 km of paved roads.

186. **Road conditions:** Roads need to be good to fair condition requiring no rehabilitation works. The percentage of roads in good condition should be between 40% and 60%. This means that, if recently rehabilitated road sections are included, there should be enough road sections in fair conditions to provide sufficient pavement works like pothole patching and crack sealing on a continued basis to provide a fairly constant work load to the contractor.

187. **Scope:** Routine maintenance, winter services (if required) and initial works to bring the road to the required service levels and the provision of management services. Initial works shall be no more than 40% of the total contract amount.

188. **Payments:** Most of the routine maintenance and the initial works shall be paid on lump sums. This requires a detailed indicative work program with cost estimates to be prepared by the consultant who prepares the contract. Risk items, for which it is difficult to estimate the quantities needed over the contract period, might be paid on unit prices. Winter maintenance might be considered a risk item as winter weather conditions can be highly variable from year to year. For short contracts this may pose a severe risk to contractors, which they might price into their offers. One option would be to fix a lump sum but with an adjustment formula to account for different winter condition severities. Emergency works also need be reimbursed on a unit price basis.<sup>38</sup>

189. **Service levels:** Service levels should be set at a reasonable and affordable level and should be enforced after the completion of the initial works, except for safety relevant service levels and management services, which need to be maintained from the beginning of the contract. Road roughness and deflection may not be used as service levels, if this is too risky for the contractor. Daily road patrolling shall be included in the scope of services.

190. **Delivery:** Except for countries that have private road maintenance contractors, contracts shall be let directly to the road maintenance teams working on the selected road network. They

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<sup>38</sup> Most of CAREC countries have a schedule of prices for maintenance activities, if these are not available a study needs to be undertaken to establish a price schedule.

would be required to form a private company and may need to incorporate additional expertise for the operation of a company such as personnel management, accounting and project management and more specific requirements for road maintenance like work planning, quality assurance and performance monitoring. Contractors should not be required to operate a pavement management system due to the short duration of the contract. The indicative work program would need to be prepared by the Consultant. Most of the required equipment might have to be leased from the road administration since the contract period is too short to justify investment in expensive equipment. An alternative would be to involve local private road construction companies who would need to acquire the necessary expertise for road maintenance and winter services by hiring, on a permanent or temporary basis, road maintenance staff from the road organization. This would allow competitive local bidding. In both cases there would be a lack of experience in performance based road maintenance, which needs to be compensated by a PBC coaching and training consultant.

191. In countries like Pakistan and Afghanistan, which have private road maintenance contractors, competitive local bidding is recommended. Besides the normal requirements for civil works, contractors need to have experience in road maintenance, winter maintenance (if required), and basic management experience related to Works Programs, Reporting, Quality Assurance System, Health and Safety Management Plans, Environmental Management Plan, Emergency Procedures and Contingency Plan, Traffic Management Plan, Inventory Database Management, Inspections and Management Information Systems.

192. Most likely, contractors will need to supplement their expertise by hiring experienced consultants. The experience level of these management services needs consideration in the context of the contract duration and local market conditions. Therefore, the hurdle for management services experience shall not be set too high to encourage participation and allow for sufficient competition. It is strongly recommended to employ a coaching and training consultant to assist the road administration as well as the contractor.

193. **Supervision:** Supervision of the PBC can be by the road organization, but it would require assistance by a PBC coaching and training consultant. The same PBC coaching and training consultant could assist the road organization as well as the contractor.

## **6.2 Option 2: Routine and Periodic Maintenance, 5-6 Years, 150-200km**

194. This option uses PBC for routine and periodic maintenance including winter services (where applicable) for a duration of 5 to 6 years covering between 150 and 250 km of paved roads.

195. **Road conditions:** Roads need to be good to fair condition requiring no major rehabilitation.

196. **Scope:** Routine maintenance, winter services and initial works, including limited rehabilitation and resurfacing works to bring the road to the required service levels. Initial works

should not exceed 50% of the total contract price. The scope would also include management services, road patrolling and the construction and operation of weigh bridges. Depending on the expected pavement deterioration pattern, it might be necessary to program resurfacing works during the contract period. Such works should be finished at least 12 months before the end of the contract period.

197. **Payments:** Management services, routine maintenance and the initial works, including the construction of weigh bridges, shall be paid on lump sum basis. Risk items, where it is difficult estimate the quantities needed over the contract period, might be paid on unit prices. With the longer contract duration, winter maintenance (where required) may be paid on a lump sum basis, since variable winter weather conditions will average out over a longer period. Emergency works need be reimbursed on a unit price basis. If resurfacing works are required during the contract period, they should be programmed in advance so tenderers can price on a lump sum basis for the respective years.

198. **Service levels:** Service levels should be set at a reasonable and affordable level and should be enforced after the completion of the initial works, except for safety relevant service levels and management services which need to be maintained from the beginning of the contract. Road roughness and deflection may not be used as service levels, if this is too risky for the contractor. Daily road patrolling shall be included in the scope of services.

199. **Delivery:** Delivery should be done through local competitive bidding. Since road contractors in most of the CAREC countries do not have experiences in road maintenance, winter services and PBCs, they would need to hire experienced maintenance staff of the existing road organizations and recruit qualified PBC consultants to provide the specific management expertise required for PBCs. Expertise in pavement management systems would not be required due to the relatively short contract period.

200. **Supervision:** Supervision of the PBC may be by the road organization, but it would require assistance by a PBC coaching and training consultant.

### **6.3 Option 3: Routine and Periodic Maintenance, 5-6 Years, 700-1000km**

201. This option pertains to use of PBC for routine and periodic maintenance for the duration of 5 to 6 years and for an extended road network of between 700 and 1000 km. This option reflects the concept of the planned performance based road maintenance project for Kazakhstan, which is more comprehensive since it includes institutional and regulatory reforms and capacity building.

202. **Road conditions:** Road conditions need to be good to fair, requiring no major rehabilitation within the contract period.

203. **Scope:** Routine maintenance and winter services (if required) and initial works to bring up the road to the required service levels. Initial works should not amount to more than 40% of

the total contract amount. The scope would also include management services, the construction and operation of weigh bridges, emergency works and patrolling services. In addition, the contractor would need to assist the road organisation(s) with their institutional and regulatory reforms and capacity building.

204. **Payments:** All maintenance works and winter services will be paid on lump sums. Initial works to bring the road to the required service levels and the construction and operation of weigh bridges will also be paid on a lump sum basis. Only emergency works will be paid on unit prices.

205. **Service levels:** Service levels should be set at a reasonable and affordable level and shall be enforced after completion of the initial works which might take between 1 and 1.5 years. During this time only safety relevant service levels and winter maintenance and management service levels will need to be enforced. Road roughness and deflection may not be used as service levels, if this is too risky for the contractor.

206. **Delivery:** The PBC will be contracted to a management contractor based on international bidding. The contractor will manage the inputs (equipment, vehicles, personnel, storage facilities) from the road organization for the maintenance works and winter services. Additional equipment need to be purchased. Initial works will be contracted out with the private sector road construction companies.

207. **Supervision:** For project supervision an independent international consultant experienced in institutional development as well as performance based road maintenance shall be employed.

#### 6.4 Comparison of Options

208. Each of the **3 options** above has **advantages and disadvantages**, which do not necessarily apply to all countries equally.

209. The **first option** has the advantage that it creates private road maintenance contractors who will learn how to maintain roads more effectively and efficiently. This will have a good demonstration effect. By gradually extending the concept to more roads, additional private road maintenance contractors will be created and eventually will compete against each other to create the competitive environment that is necessary to reap the full benefits of PBCs. At the same time the institutional, regulatory, financial and technical framework needs to be developed to guarantee sustainability. This would need to be accomplished by a separate Technical Assistance Project.

210. Another advantage of this option is that, due to the short contract duration, the risks to the contractor are limited. There is the risk that government employees might not want to form or join private companies due to an insecure employment future. Only a firm commitment of the government to continue to contract out road maintenance to the private sector could mitigate

this natural insecurity. This option would require sufficient roads with a good mix of good and fair conditions, which might be difficult to find. At the beginning there might be limited creation of value for money due to limited competition but this will most likely improve over time.

211. The **second option** has a better potential to create value for money immediately, since there will be competition between contractors. The other advantage is that the contractor has a clear incentive to deliver better quality initial works as they need to maintain the road for another 5 years. The incentive would be even higher the longer the contract period, but the IFIs might not want to finance projects with duration of more than 6 years. The main risk is that there might not be enough qualified contractors, or enough staff familiar with road maintenance and winter services to join local road contractors, and there might not be enough consultants to assist contractors to prepare the tender offer as well as assisting them during implementation.

212. Partially, this can be mitigated by an indicative work program for the entire contract period, including non-committal cost estimates to be prepared by the PPTA consultant and by coaching and training of the contractor during the contract period. The main focus should be to develop the local contracting and consulting industry. If foreign contractors are allowed to bid for the PBC, it is recommended that at least 85% of the works and services should be undertaken by local contractors and consultants with the clear obligation of the contractor to train and prepare local staff and subcontractors to bid for PBCs in the future. This should be made part of the management obligations and measured on the basis of service levels with payment reductions for non-compliance.

213. The **third option** has the advantage that it includes the required institutional and regulatory reforms and capacity building. Although it requires an international contractor well experienced in institutional reforms and performance based contracts, all works and services will be either subcontracted or performed by the existing road maintenance staff. This option will not create private PBC contractors but will enable the state-owned road maintenance contractor to manage PBCs in the future. The privatization of the state-owned road maintenance contractor would have to be done at a later stage to create competition and to reap the full benefit of PBCs. There is a risk associated with finding a sufficiently qualified management contractor, and another risk that the government might not pursue the required reforms.

214. There are other options of pilot PBCs, which are less recommended for most of the CAREC countries at this stage, which include:

- PBCs with capital works of more than 40% of the total contract amount shall be avoided since they attract contractors, which are mainly interested in the capital works only and may not give sufficient attention to the performance based maintenance works and services. In this case it might be better to contract these works under conventional civil works contracts.
- Pilot PBCs with more than 8 years seem too risky in the difficult institutional and business difficult environment of most of CAREC member countries at this stage.

- Pilot projects for community based road maintenance are also not recommended at this stage since they require a stable flow of funds which does not seem to be guaranteed in any of the CAREC countries.

## 7. Role of International Financial Institutions

215. While developed countries do not require financial assistance in implementing PBCs, developing countries may need the help of International Financial Institutions. Despite their importance, roads in many developing and transitional countries are still underfinanced, poorly managed and badly maintained. Normally, only 20% to 40% of the amounts required are spent on routine and periodic maintenance, and 1/3 of the main road networks are good, 1/3 in regular and 1/3 in poor condition. This was true 35 years ago - the situation has changed little despite heavy investments made by countries and the International Financial Institutions.

216. Most funds went to road construction and rehabilitation. New construction or major rehabilitation works may not always be justified on an economic basis. Typical rates of returns for new construction are around 10%, for rehabilitation works between 20% and 40% and routine and periodic maintenance between 50% and 100%. By failing to commit their scarce resources to road maintenance, which produce the highest economic rate of return, countries are unconsciously taking action to weaken their economies. Not spending enough to maintain existing road assets results in higher future expenditure and imposes additional costs on road users. Therefore, routine and periodic maintenance should take preference over any major rehabilitation or new construction works.

217. This requires a major shift in investment policies in the CAREC member countries. The IFIs can assist governments in undertaking the required policy shift by attaching a high priority to financing road maintenance works. IFIs can play a major role in assisting CAREC member countries to implement PBCs by financing consultancy services including: awareness seminars, training programs, feasibility and implementation studies, project preparation, supervision and coaching and training services. All of these consulting services can be designed support the successful implementation of tailored works and services for pilot PBC projects.

218. In addition, PBCs may form part of IFI financed Road Asset Management Programs, which need a long-term engagement by IFIs which goes beyond the normal project cycle. Such programmes require a major cultural shift, institutional reforms and human resource development which may well take decades, well beyond the usual IFI project duration.

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Zietlow, G. 2011. *Output and Performance-Based Road Contracts*, PowerPoint Presentation, European Bank for Reconstruction (EBRD), London, May 2011. <http://www.performance-based-road-contracts.com/pres/EBRD.OPRC.pptx>

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## Appendix 1: Types of PBCs

**Table 11:** Different types of PBCs

Type of PBC	Characteristics	Comments
<b>PBCs which require major capital works (initial rehabilitation and periodic works) - more than 30% of the total contract price - besides routine maintenance and winter maintenance - if required.</b> <i>This contract type is mainly used in developing countries due to the poor road conditions known as OPRC or Rehabilitation and Maintenance Contract RMC or CREMA</i>	Duration: Normally between 5 and 10 years. Payments: Performance based for routine and winter maintenance and lump sums for capital works. In some cases, capital works or even some routine and winter maintenance activities are paid on unit prices to minimize risks to contractors.	Contracts with less than 5 years should be avoided since they tend to attract contractors that are interested in the capital works only. Contracts with a duration of at least 8 years to reap the benefits of PBCs like providing better incentives to deliver good quality works, to introduce innovative solutions and to minimize costs. For unpaved roads contract duration is normally 4 -5 years.
<b>PBCs which require no or little initial works to bring roads to the required service levels, besides routine maintenance and winter maintenance if required and periodic maintenance.</b> <i>This contract type is also referred to as Network Management PBCs, Performance Specified Road Maintenance Contract (PSRMC) or Performance-based Management and Maintenance of Roads (PMMR)</i>	Duration: Normally between 3 to 10 years. Payments: Performance based for routine and winter maintenance and lump sums for capital works. In some cases capital works or even some routine and winter maintenance activities are paid on unit prices to minimize risks to contractors.	Such contracts require good to fair road conditions which are more found in developed countries. Shorter term contracts are mainly used to gain experience with PBCs and increase in duration over time.
<b>PBCs for routine and winter maintenance, if required.</b> <i>This contract type is also known as Service Level Maintenance Contract.</i>	Duration: Normally between 1 and 8 years. In Malaysia contract duration was 15 years, with renegotiation of price every 5 years. Payments: Mainly performance based.	Contracts require good to fair road conditions which are more found in developed countries. Shorter term contracts are mainly used to gain experience with PBCs and increase in duration over time.
<b>Simple PBCs for routine maintenance on unpaved roads.</b> <i>This contract type is known as Community Based Maintenance Contract.</i>	Duration: 1 to 3 years. Length: 20 to 40 km	Mainly used on provincial and rural road networks and in some cases on main roads as well. Works are executed by community based groups or small local enterprises.
<b>Simple PBCs for routine maintenance on paved roads.</b> <i>This contract type is also known as Microenterprise PBC which are mainly community based as well.</i>	Duration: 1 to 3 years. Length: 20 to 50 km	Mainly used on provincial and rural road networks and in some cases on main roads as well.

Source: Author

## **Appendix 2: Framework for the analysis of capacities of road organizations, contractors and consultants**

219. The main capacities to be analyzed for the road organization, contractors and consultants are as follows:

- Number and qualification of staff to implement PBCs;
- Sufficient relevant physical resources of the contractor;
- Experience in road maintenance management;
- Experience in road maintenance activities;
- Experience in road rehabilitation and improvement works;
- Experience in long term contracts;
- Quality assurance capabilities of contractors and consultants ( ISO 9001 or equivalent);
- Experience in project management;
- Pavement management system experience;
- Data collection and analysis experience and
- Experience in business risk processes

220. The deficiencies would need to be identified and an assessment would need to determine additional measures that can be taken to improve capacity through training.

221. An example of a framework for assessing the capacity of the government, contractors and consultants is illustrated in Table 12. This assessment is important to develop an implementation strategy for pilot PBCs.

**Table 12:** Framework for assessing the capacity of the government, contractors and consultants

Area	People's Republic of China			Egypt			Indonesia		
	Government	Contractor	Consultant	Government	Contractor	Consultant	Government	Contractor	Consultant
Staff Resources	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Green	Green	Green
Physical Resources	Yellow	Yellow	Green	Green	Green	Yellow	Red	Green	Red
Maintenance Management	Green	Yellow	Yellow	Yellow	Red	Red	Green	Yellow	Yellow
Maintenance Activities	Green	Yellow	Red	Green	Yellow	Red	Green	Green	Green
Quality Assurance	Green	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Green	Green
Pavement Performance and Understanding	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Green
Project Management	Green	Green	Green	Green	Green	Green	Green	Green	Green
PMS Experience	Green	Red	Yellow	Yellow	Red	Red	Green	Yellow	Green
Data Collection and Analysis	Green	Yellow	Yellow	Green	Red	Red	Green	Yellow	Green
Tender Document and Development	Green	Red	Green	Green	Red	Yellow	Green	Red	Green
Partnering Experience	Red	Red	Red	Yellow	Yellow	Yellow	Red	Green	Green
Business Risk Processes	Red	Red	Red	Yellow	Yellow	Yellow	Red	Green	Green
Legislative Capacity	Red	N/A	N/A	Green	N/A	N/A	Green	N/A	N/A

 Moderate-Sufficient capability  
 Limited capability  
 No capability  
N/A Not applicable

Source: Bennett, C.R. 2007

## Appendix 3: List of Bidding Documents Available Online

Sample Bidding Documents – Procurement of Works and Services under Output and Performance Based Road Contracts and Sample Specifications, World Bank 2006,  
[https://www.google.de/?gws\\_rd=ssl#q=sample+bidding+documents+oprc+world+bank](https://www.google.de/?gws_rd=ssl#q=sample+bidding+documents+oprc+world+bank)

Bidding Documents for Procurement of Contract under Output and Performance Based Contract (OPRC) (Asset Management Contract) for Improvement, Rehabilitation, Resurfacing & Routine Maintenance Work of Roads, Government of Punjab, 2011,  
<http://prbdb.gov.in/files/oprc/OPRC%20final.pdf>

Bidding Documents, India, Government of Bihar. <http://rcd.bih.nic.in/MBD/CMBD-28-02-2014.pdf>

Bidding documents (2006) for *Cambodia, British Columbia, Madagascar, New Zealand, Serbia and Montenegro, Tanzania, Washington D.C.* refer to [http://www-esd.worldbank.org/pbc\\_resource\\_guide/BiddingDocs.htm](http://www-esd.worldbank.org/pbc_resource_guide/BiddingDocs.htm)

Bidding documents for *Argentina, Queensland (Australia), Western Bay of Plenty District (New Zealand) and Peru* refer to: [http://www-esd.worldbank.org/pbc\\_resource\\_guide/ContractDocs.htm](http://www-esd.worldbank.org/pbc_resource_guide/ContractDocs.htm)

The HMEP: Standard Form of Contract for Highway Maintenance (Updated July 2015).  
<http://www.highwaysefficiency.org.uk/efficiency-resources/procurement-contracting-and-standardisation/the-standard-form-of-contractfor-highway-maintenance.html>

*Bidding Documents of New Zealand PBCs:*

New Performance Contract Model: Outcome Maintenance Contract (OMOC)  
Conditions of Contract  
<https://www.nzta.govt.nz/assets/consultation/mo-review/docs/omoc-conditions-of-contract.pdf>

Maintenance Specifications  
<https://www.nzta.govt.nz/assets/consultation/mo-review/docs/omoc-maintenance-specification.pdf>

Further Documents related to OMOC  
<https://www.nzta.govt.nz/searchresults?term=omoc>

State Highway Maintenance Contract Proforma Manual 2015  
<https://www.nzta.govt.nz/resources/state-highway-maintenance-contract-proforma-manual/maintenance-contract-proforma.html>

State Highway Maintenance Contract Proforma Manual 2006  
[http://www-esd.worldbank.org/pbc\\_resource\\_guide/Docs-latest%20edition/bidding%20docs/new%20zealand/ManualSection180\\_FileName.pdf](http://www-esd.worldbank.org/pbc_resource_guide/Docs-latest%20edition/bidding%20docs/new%20zealand/ManualSection180_FileName.pdf)

## **Appendix 4: List of other PBC Related Documents and Presentations Available Online**

Terms of Reference for Consulting Services refer to [http://www-esd.worldbank.org/pbc\\_resource\\_guide/TOR.htm](http://www-esd.worldbank.org/pbc_resource_guide/TOR.htm)

PBC Training Material refer to: [http://www-esd.worldbank.org/pbc\\_resource\\_guide/TrainingMaterial.htm](http://www-esd.worldbank.org/pbc_resource_guide/TrainingMaterial.htm)

Other PBC documents:

Transport Research Board: Performance-Based Contracting for Maintenance – A Synthesis of Highway Practices, 2009. <http://www.nap.edu/catalog/14266/nchrp-synthesis-389-performance-based-contracting-for-maintenance>

## **Appendix 5: Management Services (adapted from World Bank 2006)**

222. The management services include the establishment and operation of the Performance Management Unit described in para 159 above, the Communication System, the Site Regulations, the Program of Performance, Inspection System and Reporting. Special emphasis is given to the Program of Performance, which is describe in detail. The Program of Performance embraces: The Work Programs, the Operational Plan, the Winter Services Operational Plan, the Quality Assurance Plan, the Health and Safety Management Plan, Environmental Management Plan, the Risk Management Plan and the Information Management Plan.

### ***Work Program***

223. First Quarter Work Program. This program shall detail the location, extent and timing of all Services and Works the Contractor proposes to undertake during the first three months of the Contract, together with the resources of personnel, equipment and materials that will be employed. The program shall be submitted to the Project Manager for consideration and approval no later than the Start Date.

224. Annual Work Program. The Annual Work Program shall detail the location, extent and timing of all Works that the Contractor proposes to complete during the next calendar year together with the resources of personnel, equipment and materials that will be employed. For the initial year or part-year of the Contract, depending upon the Start Date, a Work Program for the remainder of the first calendar year shall be submitted to the Project Manager for consideration and approval no later than one month after the Start Date. For subsequent calendar years, the Annual Work Program shall be submitted to the Project Manager for consideration and approval no later than one month before the commencement of each calendar year.

### ***Operational Plan***

225. The Operational Plan shall describe how the Contractor will undertake the Services (excluding Winter Service) to achieve the Operational Service Levels, including but not limited to the following matters:

- Organisational structure for management and delivery of the Services;
- Locations and coverage of, depots and storage facilities;
- Numbers, classification and deployment of equipment and personnel;
- Provisions for procurement and storage of materials;
- Arrangements for meteorological data collection and weather forecasting;
- Procedures for Safety Inspections and Service Level Inspections;
- Procedures for Structural Inspections;

- Procedures for routine maintenance and repair works;
- Procedures for incident response and emergency works;
- Procedures for response to third party enquiries, reports and complaints.
- Procedures for entering and maintaining accurate and timely data in the MIS.

### ***Winter Service Operational Plan***

226. In addition to the above, the Winter Service Operational Plan shall describe how the Contractor will undertake the Winter Service to achieve the Operational Service Levels, including, but not limited to the following matters:

- Organisational structure for management and delivery of the Winter Service;
- Locations and coverage of winter service stations, depots and storage facilities;
- Design and location of snow protection measures including: snow isolating, snow diverting, snow capturing and snow detaining structures – either permanent or temporary.
- Provision and deployment of snow poles to mark the road edges during severe weather.
- Numbers, classification and disposition of winter service equipment and personnel;
- Provisions for procurement, disposition and storage of salt and other de-icing materials;
- Arrangements for meteorological data collection and weather forecasting;
- Work plans for each defined weather and road condition;
- Procedures for supervision and control of performance of winter service;
- Approach to and methods of measuring and recording skidding resistance achieved during winter service operations (as a minimum, one measurement each minute by each snow plough/gritter or similar vehicle);
- Procedures to be adopted when for its own safety traffic has to be restricted or closed for some types of vehicles and logistics for implementation of restrictions;
- Readiness levels for each defined weather and road condition, including: resource availability and deployment; contingency planning; monitoring and reporting;
- Developing and applying procedures to guarantee the required skid resistance during winter conditions
- Methods of dissemination of information on the condition and passability of roads.

### ***Quality Assurance Plan***

227. The purpose of the Quality Assurance Plan is to integrate the requirements of the Contract and the quality assurance systems to deliver the Services. The Quality Assurance Plan describes the methods and procedures, which the Contractor will apply for the execution of the Contract, including how the Contractor will:

- (a) identify the quality requirements specific to the Contract;
- (b) plan and execute the Services and Works to satisfy those requirements;

- (c) inspect and/or test work and materials to ensure compliance with the quality requirements;
- (d) record and monitor the results as evidence of compliance;
- (e) audit the Quality Assurance processes and procedures to ensure compliance; and
- (f) ensure that prompt action is taken to correct non-compliance.

228. The Quality Assurance Plan shall comply with the principles of ISO9001. It shall clearly describe the systems, procedures and methods that will be used to deliver and monitor compliance of the Services.

### ***Health and Safety Management Plan***

229. The purpose of the Health and Safety Management Plan is to foster a responsible attitude towards occupational health and safety and to comply with the provisions of local laws.

230. Because of the nature of the Services, the Contractor may occasionally be exposed to hazardous situations, which could involve risk of various degrees of harm, to the Contractor's personnel and/or the public.

231. Situations will arise when it is not practical to eliminate or isolate significant hazards. In these situations, the Contractor must mitigate hazards by ensuring planned protection systems (e.g. equipment, clothing) are available and used. The Contractor's personnel and all sub-contractors must comply with the Health and Safety Management Plan at all times.

232. The Health and Safety Management Plan shall, when implemented in accordance with the plan requirements:

- Ensure the systematic identification of existing and new hazards on work site(s) and at depots, storage facilities, in offices or wherever activities are undertaken;
- Ensure the mitigation of significant hazards, where elimination and isolation are impractical;
- Ensure the provision and use of appropriate protective measures;
- Include emergency procedures for dealing with accidental spillage, pollution or imminent danger;
- Ensure regular review and assessment of each hazard identified and monitor employees exposure to these hazards;
- Ensure reporting and recording of work site safety incidents so health and safety problems can be addressed quickly and regularly. It is a requirement of this Contract that any such incident be advised promptly to the Project Manager;
- Comply with all other health and safety aspects requirements of local laws and regulations.

### ***Environmental Management Plan***

233. The purpose of the Environmental Management Plan is to foster a responsible attitude towards occupational health and safety and to comply with the provisions of the local laws. The Environmental Management Plan shall comply with the principles of ISO14001.

234. Because of the nature of the Services, the Contractor's operations have the potential to cause adverse environmental impacts. Situations will arise when it is not practical to avoid such impacts. In these situations, the impacts must be mitigated by planned actions and protection measures, which must be employed.

235. The Contractor's personnel and all sub-contractors shall comply with the Environmental Management Plan at all times.

236. The Environmental Management Plan shall, when implemented in accordance with the plan requirements:

- Set out a clear and coherent environmental management policy of the Contractor;
- Describe the overall environmental management system of the Contractor;
- Ensure the systematic identification of potential environmental impacts associated with the Contractor's operations and/or the use of the roads;
- Ensure the mitigation of significant environmental impacts, where elimination and isolation are both impractical;
- Ensure the provision and use of appropriate protective measures;
- Include emergency procedures for dealing with accidental spillage, pollution or imminent danger;
- Ensure regular review and assessment of each impact identified and monitor effectiveness of mitigation or protection measures;
- Ensure reporting and recording of significant incidents causing environmental impacts so that problems can be addressed quickly and regularly. It is a requirement of this Contract that any such incident be advised promptly to the Project Manager;
- Comply with all other environmental protection requirements of the relevant law and regulations.

### ***Risk Management Plan***

237. The Purpose of the Risk Management Plan is to ensure that uncertain events that may have adverse impacts on the integrity and condition of the road assets or on the Operational Service Levels are identified, analyzed and placed under a proactive management regime. The Risk Management Plan shall, as a minimum, include:

- establishment of a risk register, in which all foreseeable adverse events are identified and assigned values of probability and consequence of occurrence;
- analysis of risks in which the impact of potential combinations of events is considered across a range of scenarios;

- identification of risk management strategies involving avoidance and mitigation of risks together with management strategies for residual risks;
- assignment of responsibility for risks to the organisations or individuals best able to manage them;
- a process for the regular review and updating of the risk register and the risk management plan.

### ***Emergency Procedures and Contingency Plan***

238. The Emergency Procedures and Contingency Plan shall establish the roles, practices and procedures to be followed during and following the occurrence of natural phenomena with unforeseen consequences, such as strong storms, flooding and earthquakes. The Emergency Procedures and Contingency Plan shall be developed by the Contractor and agreed with the Project Manager and any other stakeholders the Project Manager may identify.

239. The purpose of the Emergency Procedures and Contingency Plan is to ensure the safety of the Contractor's personnel and road users in the case of emergency and/or road closure. It should include:

- an effective communication and event recording system;
  - the names, 24-hour contact telephone numbers and specific duties of the Contractor's personnel nominated to respond to an emergency event;
  - the contact telephone numbers of other parties who need to be notified in cases of emergency events, e.g. police;
  - detailed response procedures for all potential emergency events;
- (a) possible detour routes in the event of road closure.

### ***Traffic Management Plan***

240. The Traffic Management Plan establishes the practices for traffic management at work sites and shall comply with the relevant local rules and regulations. The Traffic Management Plan must be developed by the Contractor and agreed with the Project Manager. The objectives of the Traffic Management Plan are to:

- clearly define and document the responsibilities and chain of command for the development, implementation and management of traffic control measures and systems,
- establish the minimum requirements for temporary traffic control,
- establish the minimum geometric, cross section and surfacing standards for temporary works,
- provide appropriate transitions and enable safe and efficient traffic flow into, through and out of work sites,
- protect the Contractor's personnel at all times,
- protect the Road and related assets and the Contractor's resources at all times, and
- meet the operational requirements for the Road.

241. The Traffic Management Plan must include at least the following:

- a documented process for preparation, review and approval of the Traffic Management Plan;
- a document tracking and control system to ensure that only the latest operative copy of the Traffic Management Plan is in circulation;
- 24-hour contact telephone numbers for Contractor, Project Manager, emergency services and other stakeholders; and
- layout diagrams, method statements, etc. for implementation of traffic control while undertaking each aspect of the Services (including site specific layout diagrams and method statements if the Services require traffic control measures not covered by standard codes of practice).

#### ***Information Management Plan***

242. The Information Management Plan establishes the practices for collection, storage, analysis and reporting of data and information required for the administration and management of the Works and Services. The Information Management Plan shall be developed by the Contractor and agreed with the Project Manager.

243. The foundation of the Information Management Plan is to be the Management Information System (MIS), which the Contractor shall develop and maintain. This Management Information System shall, among other functions:

- ensure establishment of a reliable computer system that will fully support the business processes associated with the OPRC Pilot Project, in particular the recording of compliance with management and operational service levels.
- enable ready and equitable identification of non-compliance with Service Levels and computation of payment reductions consequent upon such non-compliance.

244. The MIS shall be accessible to the Project Manager across the internet using computers and associated equipment provided by the Contractor and having access to a broadband internet connection. The Contractor shall provide secure user accounts giving access to those areas of the system necessary to enter data and to produce reports that form part of the monthly reporting requirements set out in this Specification.

245. The Contractor shall use Mobile Personal Computers (MPCs) on site to collect Inventory and Survey data. Data shall be able to be loaded both from the MIS into MPCs and from MPCs into the MIS. The Contractor shall provide suitable MPCs and related software according to a specification prepared by the Contractor and approved by the Project Manager. The Contractor shall determine the number of MPCs to meet his business needs.

246. The Project Manager shall be given access to sufficient information on the specification and processes employed by the MIS to enable an understanding of the accuracy and reliability of the reports produced by the system.

247. As part of the Information Management Plan, the Contractor shall prepare a Data Collection Plan, which shall describe the methods and frequency of data collection together with the approach to be taken to quality assurance and quality control of data.

248. The Information Management Plan shall define processes and procedures for entry of data from inspections and other sources to the MIS in a timely manner and for the preparation of reports required by the Contractor for the effective delivery of the Works and Services and by the Project Manager for demonstration of compliance and entitlement to payment.

249. The Contractor shall collect the data in accordance with the Data Collection Plan at the levels of accuracy, currency and completeness specified as appropriate to the uses for which the data is intended and shall then enter the data to the MIS.