

## PERFORMANCE-BASED ROAD MAINTENANCE - DURATION OF CONTRACT AND IMPLEMENTATION STRATEGY

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***Summary:** Within the past 20 years there has been a shift in implementing contracted road maintenance through the use of performance-based methods. In most developed countries, performance- or output-based contracting of road maintenance operations has been effective, where appropriate conditions and institutional settings have been in place. It requires careful preparation in order to create a contract that is balanced and feasible, providing an adequate incentive for private sector participation. The paper presents the discussion and advice on the duration of such contracts, as well as on the long-term strategy to implement these.*

***Keywords:** roads, performance-based maintenance, contract, strategy*

### 1. INTRODUCTION

Road maintenance includes both routine and periodic activities. Routine maintenance consists of a multitude of, generally minor, tasks aiming at maintaining the function and structure of the road (such as pothole repairs, sealing of cracks, cutting of vegetation, cleaning signs, repairing minor damages, etc.). Periodic maintenance consists of more extensive measures, required at less frequent intervals, such as asphalt concrete overlays, aiming to make good cumulative wear and tear which is beyond the scope of routine maintenance operations to rectify. A key aim of periodic maintenance is generally to strengthen pavements for further use whilst reducing roughness to provide economic benefits.

Over the years there has been a gradual progression in road maintenance philosophy [1]. In general terms, it was traditionally carried out directly by the road authority with its own maintenance organization supplementing its own capacity, to a greater or lesser degree, by contracting some works to contracting companies. Within the last 20 years, however, there has been a shift in implementing contracted maintenance through the use

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of performance-based methods. Under this Performance-Based Maintenance (PBM) methodology, the contract is based on the concept of payment for specified results (resulting in a well maintained road) based on the contractor meeting specified standards of performance rather than measuring and paying for the quantities of work which he actually does, i.e. based on outputs. It is a logical development in a sequence of evolving maintenance practices which have developed from direct labor to contracted maintenance through admeasurement contracts to PBM.

In most developed countries [2], performance- or output-based contracting of road maintenance operations has been effective, where appropriate conditions and institutional settings have been in place. It requires careful preparation in order to create a contract that is balanced, provides an adequate incentive for private sector participation, and is feasible.

Extensive road maintenance projects (mainly rehabilitation and reconstruction) were implemented in the last 15-20 years in most of the developing countries, however there has been no significant change in road maintenance practices, mostly because of inadequate, unstable and non-continuous financing, lack of managerial and strategic capacity, and very strong orientation to new investments originating from highly vigorous local political will [3, 4]. Insufficient or uncertain budgetary allocations to road maintenance have resulted in road deterioration that has significantly increased production and transport costs.

The main goal of this paper is to point out and provide advice on two important and interrelated elements concerning the contracting of PBM works, namely: duration and strategy of contract implementation.

## 2. OVERVIEW OF PBM

Road maintenance is usually carried out through one of three contracting methodologies (Table 1). The three methodologies are not wholly separate and a considerable amount of overlap between the different models can occur.

*Table 1. Contracting methodologies for road maintenance [1, 4]*

Model	Description
In-house (direct labor)	The road authority uses its own staff, labor and resources.
Measurement (input) based maintenance	External contractors work under the instructions/inputs of the road authority staff and are paid using unit rates applied to the measured volumes of work items executed. Contractors are usually selected through some form of open tender procedure.
Performance (output) based maintenance	Contractors are paid a fixed rate or lump sum for maintaining an identified road or group of roads to predefined standards, regardless of the works required.

PBM is the most recent maintenance model. It places the responsibility for operational decisions on the contractor and simply requires roads to be maintained to set standards. The progression through the three models (Figure 1), which can be generally noticed

worldwide, has been driven principally by the desire for better maintenance and/or reduced maintenance costs and it is generally accepted that PBM, effectively implemented, will provide either the same level of maintenance for less money or a higher level of maintenance for the same money than its predecessors.

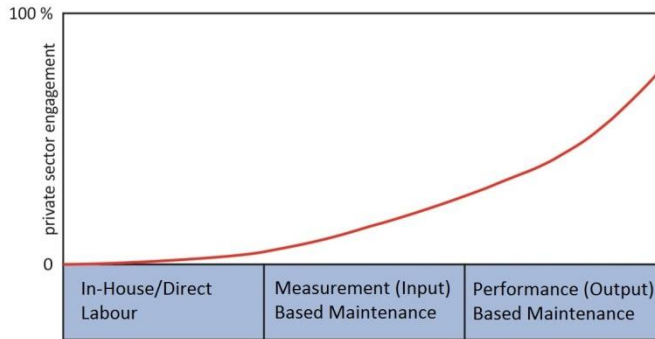


Figure 1. Private sector involvement and incentive through contracting models [1]

The basis of any Performance-Based Contract (PBC) is that the employer describes to the contractor the product which he requires and the employer then pays the contractor for providing that product. In the case of the road Performance-Based Maintenance Contract (PBMC) the end product is a road or group of roads maintained to certain defined standards throughout the duration of the contract. PBC is generally suitable for any type of road works, from routine, periodic and emergency maintenance, through improvement and rehabilitation, to rehabilitation and construction.

PBMCs differ significantly from method-based contracts that have been traditionally used to maintain roads. The basic difference is that under the PBMC, most of the payments to be made to the contractor are based on measured “outputs” reflecting the target conditions of the roads under contract (in other words: “what the roads are supposed to look like”), expressed through Levels of Service (LoS). These LoS are defined in the contract. Another major difference is that the contractor is fully responsible for the design of the works which are necessary to reach the required LoS, and the durability and performance of the roads over a longer period.

Therefore, the essence of the PBM concept is that the contractor undertakes to carry out all necessary maintenance to a road or roads to keep them at a predetermined required standard. There is no measurement of the volume of works carried out and the road authority does not dictate to the contractor what should be done or when it should be done.

Direct cost implications aside, the attractions of the PBMC model from the authority’s viewpoint, are that it should reduce the technical inputs (and therefore the staffing levels) as well as physical infrastructure (maintenance depots, equipment, stockpiled materials, etc.) required from the government agency to a minimum, whilst providing a guaranteed, consistent, visible level of maintenance throughout the contract period and across all the contract road sections.

From the contractors’ side, the attraction is that in return for receiving a smooth monthly income they are free to organize the works needed to accomplish this in the manner that

best suits them, i.e. in the most economical manner for them in terms of applying the lowest cost organizational and technical model for delivery of standard of maintenance specified by the contract. As the fixed revenue side for the contractor is no longer a variable of interest, his focus shifts to delivering the required quality at least possible cost.

Contractor's performance under PBMC is based on self-compliance with his own (road authority-approved) self-control/quality assurance system and is periodically checked by formal and informal monthly monitoring inspections (instead of staff-extensive day-to-day works supervision), complemented by road user complaints (if any) in case of non-conformance with expected LoS and Maintenance Standards (MS), and the information originating from road authority's automated Management Information Systems (MIS), when these are in place.

### 3. DURATION OF CONTRACT

To get the most economies from the arrangement, the contractor requires time to set up operations and to amortize his organization and equipment. Longer contracts ensure that the contractor has an incentive to carry out works with their future performance clearly in mind and, additionally, long contracts assist with the economic planning and execution of periodic maintenance works (e.g. resurfacing) which are repeated only at infrequent, multi-year intervals. Contracts should be as long as practical, certainly from 5 years to 10 years, and can go up to 30 years. In such a long term "comprehensive" PBMC, much of the works are often outsourced by the main contractor to subcontractors.

Although initial (pilot) PBMCs are frequently relatively short term (perhaps only 3 to 5 years), often due to artificial constraints imposed by budget regulations and funding agencies or to a reluctance by the road authority to commit to a long term project using new methods, in the longer term, it is better if contracts can be made longer. PBMCs for up to 5 or 7 years are common and longer periods not unusual. This gives the contractor, working on a 12-month seasonal cycle, the chance to develop and optimize his management and organization, and to set off much of the initial costs involved in a new venture against the long term operating income. To clarify the term "new venture" - under PBMC, the contractor should purchase/lease equipment, hire qualified staff, rent offices and warehouses, invest in inventory and incur the cost for all of the above initially, in expectation to recover such cost throughout the length of the contract.

Ultimately, these long term contracts are to the road authority's benefit, they produce better, more experienced contractors who are able to lay off substantial one-time costs over much longer periods, whilst the use of fewer, longer contracts greatly reduces the road authority's procurement workload.

Restriction of funding to medium-term at best is a congenital problem for most funding agencies. However, in many cases more severe problems arise for statutory organizations such as cities and/or municipalities who may have little control over their budgets beyond the present year and no way at all to secure the availability of funds over a 5- or 7-year contract.

#### 4. IMPLEMENTATION STRATEGY

Typical (although not mandatory) evolution of a PBM program is shown below (Table 2). Depending on specific circumstances prevailing in particular country, certain steps in the sequence presented in Table 2. can be skipped or merged and duration of PBMCs can be modified if feasible and if suiting better the actual situation and specifics of the country. For example, there is a potential for trading-off between geography and duration so that by bundling fewer/better roads, in cases where other requirements are met, it is possible to have longer initial PBMCs or even to combine them immediately with elements of asset management. Similarly, in the case of Western Balkan countries, knowing the prevailing circumstances and conditions, in particular the general practice and approach to maintenance, it is advisable to commence with the 1<sup>st</sup> generation pilot PBMC and gradually improve (i.e. to follow the examples of Albania and Serbia [4]).

Table 2. Progression of PBMC - time line

PBMC type	1 <sup>st</sup> generation pilot PBMC	2 <sup>nd</sup> generation PBMC	Comprehensive PBMC	Comprehensive PBMC + asset management
duration	3-5 years	5-7 years	5-10 years	15+ years
pavement maintenance	✓	✓	✓	✓
drainage maintenance	✓	✓	✓	✓
maintenance of signalization and equipment	✓	✓	✓	✓
trees and vegetation control	✓	✓	✓	✓
road cleaning	✓	✓	✓	✓
winter maintenance	PB + BoQ	PB + BoQ	✓	✓
emergency maintenance	BoQ	BoQ	BoQ	BoQ
minimal rehabilitation	BoQ, if unavoidable	PB or BoQ	✓	✓
major periodic intervention	-	PB or BoQ	PB or BoQ	PB or BoQ
major rehabilitation	-	-	PB or BoQ	PB or BoQ

PB - performance-based; BoQ - Bill of Quantity, i.e. admeasurement, input-based

The pilot PBMC for a period of 3 years will be more productive than immediate full implementation. This is considered long enough for an assessment of performance, since the contract should be essentially for routine maintenance only. 3 years will give the eventual bidders and road authorities a chance to come to grips with the notion of the multi-year contract without tying all parties into a longer term format which requires revision. Most importantly, longer term (3 years) pilot PBMC, with prospect of potential

even longer follow-up full PBMC (5+ years) would boost chances of successful growth of public and private companies, as investors generally prefer long-term stability and business viability for their investment.

### 4.1. 1<sup>st</sup> generation pilot PBMC

The first step for most road authorities who have decided that they need to move towards a system of PBM contracting was consideration of a pilot project, very often with support of International Financing Institutions (IFIs).

The purpose of a typical pilot project is to:

- test the existing institutional framework for longer term implementation of PBMCs;
- induce institutional, legal, organizational and financial changes in road maintenance system in order to enable implementation of PBMC;
- test market readiness for PBMCs;
- establish the right balance of risk allocation between private and public sector in PBMC;
- create critical mass of knowledge and expertise on PBM in the road authority and other stakeholders, like the control/audit authorities;
- build up capacity of the local contracting industry to implement new type of maintenance contracts.

Duration of a pilot contract is usually minimum 3 years, very often optionally extendable to, for example, 5 years. The duration of the pilot contract can be dictated by many factors, some of them being natural road maintenance/rehabilitation cycles and the economic exploitation periods for road maintenance equipment.

Also, implementation of a pilot contract is usually constrained to only a carefully selected part of the network - so called pilot area - where new concept is being tested mostly in isolation from other areas where road maintenance continues to be executed in a traditional manner.

In selecting road sections for inclusion in a pilot PBM project, try not to be influenced by political or other outside considerations. The pilot project is still a PBM project - not a rehabilitation project.

Although some pilot PBMCs may also include initial rehabilitation as well as routine maintenance, it is recommended to keep rehabilitation and routine maintenance separate, at least in the initial (pilot) stages of PBM programs, and to include only routine maintenance in the pilot PBMC due to usually high rehabilitation costs (resulting from the huge maintenance backlog) which in turn overshadow the maintenance component costs. Alternatively, to ensure that the pilot PBMC is long enough (minimum 7 years) to take into account the road life cycle and the need for increased maintenance that usually arises 5 years following the new construction or road rehabilitation/capital repair.

In considering the construction and implementation of a pilot PBMC, attention must be paid to the timing and the amount of time likely to be consumed in the preparatory stages. Commencing with the need for possible legal and regulatory changes and allowing reasonable times for the procurement of technical assistance services as well as the actual PBM procurement, the time required for the implementation of even a 3-year pilot project could easily run to 4 years in total (Figure 2).

### 4.2. 2<sup>nd</sup> generation PBMC

Following implementation of a pilot PBMC, particularly if it was successful, the logical step forward is to expand the program to a larger portion of the road network and to improve PBMCs based on lessons learned during the implementation of a pilot project by launching 2<sup>nd</sup> generation of PBMCs.

Activity	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1st generation contracts (3-year pilot PBMC, preferably hybrid and routine maintenance only for 300-500 km)																
Enabling legal and financial conditions to introduce PBMC	■	■														
Procure Initial TA		■	■													
Develop Maintenance Standards				■												
Assess local Contracting and Consulting capacity				■												
Assess Roads Generally				■												
Preparation of templates for PBM bidding documents for pilot project				■	■											
Data collection for preparation of PBM bidding documents for pilot project				■	■											
Selection of pilot areas for PBM pilot project for routine maintenance				■	■											
Preparation of bidding documents for PBM pilot project for routine maintenance						■										
Procure Project Management TA						■										
Training for potential bidders						■	■									
Procurement of pilot PBM contracts							■	■								
Pre-bid workshop							■	■								
Contract award for pilot PBM contracts								■	■	■	■	■	■	■	■	■
Implementation of pilot PBM contracts									■	■	■	■	■	■	■	■

Figure 2. Typical timeline for implementation of pilot PBMC [4]

Whilst some interim institutional solutions can be put in place to enable commencement of a pilot project, by the time when 2<sup>nd</sup> generation PBMCs are about to be launched, proper institutional and legal reforms facilitating PBM should be put into effect as permanent solutions.

Typical duration of 2<sup>nd</sup> generation PBMCs is 5 to 7 years, and they usually include routine plus elements of periodic maintenance.

### 4.3. Comprehensive PBMC

Once shift towards PBMCs is successfully made through pilot contracts (one or two generations) and the institutional environment is reformed through practical implementation of PBMCs in previous stage, a more complex forms of PBMCs, so called “comprehensive” PBMC can be introduced.

As noted above, a “comprehensive” PBMC could cover all road assets within the right-of-way and comprise the full range of services needed to manage and maintain the contracted road corridor.

Such contracts would include routine maintenance, periodic maintenance, emergency maintenance, traffic accident assistance, etc., and are usually awarded for much longer periods - usually from 5 years to 10 years or more.

### 4.4. Comprehensive PBMC + asset management

A mature PBM environment can move forward and combine PBM with full-scale asset management. In essence, this means that the road asset is handed over by the road authority to a private contractor under long-term concession (public-private-partnership) of 15-30 years. In principle, the contractor is obliged to manage and maintain the asset in a condition equal to or better from the one in the moment when he took over the asset from the road authority.

In practice, like in previous generations of the PBMC, this is achieved through the requirement that the contractor complies with contractually pre-defined performance criteria that enable at least the same or better LoS for road network subject to PBMC throughout the implementation of the PBMC. Naturally, the road authority should have LoS and the corresponding performance criteria defined prior to award of such PBMC and a detailed condition survey is necessary prior to tendering in order to set benchmark for measuring the compliance with contractual performance criteria.

## 5. LEGAL FRAMEWORK AND LONG-TERM FUNDING

Commitment to long-term funding for multi-year PBMCs can be problematic because of strict fiscal regulations, the unavailability of suitable budgetary framework instruments and lack of political will to understand and comply with the financial obligations undertaken when signing the contract, non-flexibility to transfer unused fund from one year to another [3, 4]. Budget responsiveness is an immensely important factor for the PBMC and the contractors if they are to really undertake the risks associated with partnering with the government. The government cannot demand service quality levels that it cannot pay for and has to enable such conditions. Thus, securing sufficient funds for multi-year PBMCs prior to their commencement is ultimate requirement for success of a PBMC project.

In the case of eventual legal obstacle on the length of the contract which may be entered into, in certain occasions the problem can be resolved through the fact that national legislation permits the application of supra-national principle that IFI loan conditions take precedence over the national law. However, such use of the IFI conditionality is only a temporary expedient convenient for early stages of a PBM contracting program (pilot and 2<sup>nd</sup> phase PBMCs) and will not cover the eventual situation where the road authority will need to make its own contracts using national funding.

Appropriate payment mechanisms (once funding is secured) for PBMC project have to be ensured within the existing fiscal framework [1, 4]. Multi-year contracts are usually limited to maximum 3-4 years and it is unclear if the PBMCs can be successfully implemented and the goals achieved within this limited period in terms of “value for money“ and “inputs against outputs“, without implementing changes in national legislation. At present, for all Western Balkan countries, each year’s budget is subject to availability of funds and decisions about relative priorities. The full benefits of multi-year PBMCs cannot be realized with such a system.

Long-term solution is appropriate revision of the national legislation and financial regulations to enable multi-year road maintenance contracts and adequate multi-year budgetary framework when planning the national budget. If this is not done, successful



implementation is, almost by definition, impossible. These revisions should address at least:

- appropriate duration of the contract, depending on the budget planning framework;
- enable transferring unspent maintenance funds from one year to another.

It is recommended that legal or procedural means be found to give contractors a much greater degree of certainty about the revenue they can expect from a multi-year contract. For example, the Ministry of Finance (MoF) might adopt and announce an internal policy to honor multi-year fixed-payment contracts up to a defined ceiling in each sector, or in the roads sector alone, irrespective of future budgetary restrictions. Another option in order to give full effect to the results of PBMCs would be to develop such amendments to allow conclusion of multi-year contracts for the period beyond the current limit of 3-4 years. As construction contracts also usually extend beyond one year, the risks are similar for multi-year PBMCs. The contracting road authority can mitigate these financial risks by giving priority in its budget proposals to contractual obligations relating to past years.

The resolution of financing problems cannot be solved by the road authority alone [1]. It is a matter for government as a whole and for treasury in particular. The road authority must develop a clear case outlining the improvements in road maintenance which will accrue from the adoption of PBM, the economic benefits which these will bring (primarily reduced vehicle operating costs), the improvements in public (voter) relations which will result from improved road conditions and the ultimate savings which will be made in overall road expenditures.

The MoF needs to be involved, in addition to the road authority and the ministry responsible for road infrastructure. IFIs support may be necessary to push through legal changes to enable implementation of PBMCs and obtaining full support from policy and decision makers in the government.

## 6. CONCLUSION

The experience from countries with lengthy implementation history of PBMCs indicates that the number of factors are key to successful implementation of the PBM approach. Out of these, proper selection of contract duration and implementation strategy, beside fair incentives, have significant potential to provide attractiveness for contractors so they can decide to enter into maintenance business which is essentially a multi-dimensional issue in which the management and technical aspects are influenced by political, social and institutional issues. Analysis of lessons learned from implemented PBMCs, as well as key issues and challenges for transition countries, have led to proposals and recommendations how to select the approach to the successful PBMC for roads.

As presented above, passing through certain phases is the best way to introduce a full PBMC which, in addition to routine network maintenance, will include periodic maintenance activities and eventually would mature to the full asset management contract. The roadmap for starting the PBMC implementation is practically shown under the section 4, with details of the possible strategy for the implementation of the contract, and the steps and timeframe for starting the pilot PBMC.

## REFERENCES

- [1] Note on performance-based maintenance of roads, Ministry of Public Works and Housing, Hashemite Kingdom of Jordan, Technical Assistance for the Transport Sector, World Bank, Washington, D.C., **2018**.
- [2] Gericke, B., Henning, T., Greenwood, I., Review of performance based contracting in the road sector-Phase 1, Transport Paper No. 42A, The World Bank, **2014**.
- [3] Jokanović, I., Begović, E., Radović, N., Challenges and success factors in implementation of performance based maintenance contracts, Proceedings of the 5<sup>th</sup> B&H Congress on Roads, Sarajevo, Bosnia and Herzegovina, **2016**, p. 367-382.
- [4] Policy paper on infrastructure, Policy challenges in the implementation of performance-based contracting for road maintenance, European Bank for Reconstruction and Development, London, **2016**.

## ODRŽAVANJE PUTEVA PREMA UČINKU - TRAJANJE UGOVORA I STRATEGIJA REALIZACIJE

**Rezime:** U proteklih 20 godina došlo je do pomaka u primeni ugovora za održavanje puteva kroz korišćenje metoda zasnovanih na učinku. U većini razvijenih zemalja, ugovaranje aktivnosti održavanja puteva zasnovanih na učinku je bilo efikasno, ali uz postojanje odgovarajućih uslova i institucionalnih aranžmana. Ovo zahteva pažljivu pripremu kako bi se stvorio balansiran primenljiv ugovor, koji adekvatno podstiče učesće privatnog sektora. U radu je prikazana diskusija i saveti o trajanju ovakvih ugovora, kao i o dugoročnoj strategiji za njihovu primenu.

**Ključne reči:** putevi, održavanje prema učinku, ugovor, strategija