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Performance-based contracting for roads – experiences of Australia and Indonesia

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Abstract

Many countries over the last decade, have used performance-based contracting (PBC) to manage and maintain roads. The implementation of PBC provides additional benefits for the government/public such as cost savings and improved conditions of contracted road assets. In Australia, PBC is already being implemented on all categories of roads: national, state, urban and rural. Australian PBC arrangement is designed to turn over control and responsibility for roadway system maintenance, rehabilitation, and capital improvement projects to private contractors. Contractors’ responsibilities include determination of treatment types, the design, programming and the undertaking of works needed to maintain road networks at predetermined performance levels. Indonesia initiated two PBC pilot projects in 2011, the Pantura Section Demak-Trengguli (7.68 kilometers) in Central Java Province and Section Ciasem-Pamanukan (18.5 kilometers) in West Java Province. Both sections are categorized as national roads. The contract duration for both of these projects is four years. To facilitate a possible way forward, it is proposed to conduct a study to understand Australia’s experiences of advancing from pilot projects to nation-wide programs using PBC. The study focuses on the scope of contracts, bidding processes, risk allocation, and key drivers, using relevant PBC case studies from Australia. Recommendations for future PBC deployment nation-wide should be based on more research associated with risk allocation. This will include investigation of standard conditions of contract. Implications of the contract clauses for the risk management strategy to be adopted by contractors. Based on the nature of risks, some are best managed by the project owner. It is very important that all parties involved to be open to the new rules of contract and to convince themselves about the potential increased benefits of the use of PBC. The most recent states of challenging issues were explored and described.

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1. Potential Benefits of Implementing PBC for Roads

A performance-based contract (PBC) differs significantly from a method-based contract that has been traditionally used to maintain roads. In PBC, payments for the management and maintenance of road assets are explicitly linked to the contractor successfully meeting or exceeding certain clearly defined minimum performance indicators. While traditionally, the road agency as a client normally specifies techniques, technologies, materials and quantities of materials to be used, together with the time period during which the maintenance works should be executed. The payment to the contractor is based on the amount of inputs (e.g., cubic meters of asphalt concrete, number of working hours, etc.).

The client specifies performance indicators that the contractor is required to meet when delivering maintenance services. Performance is calculated based on several level of services defined through road users perspective, which may include but not limited to, vehicle velocity, rider comfort, and safety. For example, the contractor is not paid for the number of potholes he has patched, but for the output of his work: no pothole remaining open (or 100% patched). There are penalties in case of failure to comply with the performance indicators or failure in executing timely actions. Otherwise, the payment can be regularly made, usually in equal monthly installments. PBC for roads can be "hybrid," i.e., combines features of both method- and performance-based contracts [1]. With contractor’s initiative in setting out their own work methods, an increase in the efficiency of public funds usage is to be expected and also to encourage technological innovation in the construction industry.

Studies by The World Bank suggest that road agencies adopting PBC approach have claimed the following achievements: i) cost savings from 10% up to 40%; ii). expenditure certainty, iii). reduction of the in-house workforce, iv). improved conditions of contracted road assets and reduction of roads in poor condition, v). greater road user satisfaction, and vi). multi-year financing of a maintenance program.

Realizing these potential benefits, The Ministry of Public Works (MPW) have implemented two PBC pilot projects started in 2011 for the maintenance of a small portion of the Northern Java road network. The road agency is also laying the foundation for future expansion of the PBC approach after the pilot trial.

2. PBC for Roads – Challenges in Indonesia

In order to achieve the benefits of PBC, the challenges that road agencies face around the world include the allocation of risks to the party that is able to manage them best. In a long-term contract such as PBC, there should be a “partnering” relationship between the contractor and the client. Another difficulty is the identification and clear definition of appropriate performance indicators.

Opus International on behalf of The World Bank have studied the framework for introducing PBC to Indonesia [2]. In the beginning of their study, they identified three key items to be addressed to enable performance based contracting to be successfully implemented in Indonesia. These are:

- Concerns about overweight vehicles (overloading)
- Concerns about the quality of the existing road construction
- The ability of the Ministry of Finance to enter into a multi-year maintenance contract

There were other issues but can be considered secondary to the above three items. Ensuing The World Bank recommendations, the Ministry of Public Works have implemented two PBC pilot projects in 2011, the Pantura Section Demak-Trengguli (7.68 kilometers) in Central Java Province and Section Ciasem-Pamanukan (18.5 kilometers) in West Java Province. Both sections are categorized as national roads. The contract duration for both projects is four years.

Those pilot projects were then evaluated in Wirahadikusumah et al. [3]. There were challenges that can be learned for the next pilots. This study focused on identifying the driving factors to achieve higher benefits and/or lower costs (“value-for-money”) in such projects. Indonesian contractors and clients agreed that PBC is logical as a form of
alternative contract type which may deliver additional benefit/value (which may be followed by cost reduction) compared to the traditional type of contract currently in use in the delivery of national roads. From literatures, twenty driving factors for PBC implementation were been identified. These were confirmed in the case study, and two additional drivers were also identified. The lessons learned from the two pilot projects of PBC on Indonesian roads were mainly the importance for all parties involved to be open to the new rules of contract and to convince themselves about the potential increased benefits of the use of PBC.

Based on the study, four driving factors are main prerequisite, i.e., “Implementation of output specification,” “Implementation of clear and measurable outcome,” “Budget availability,” and “Implementation of performance specification. All four factors should be stated clearly within the PBC’s clauses. Respondents believed that if the government will extensively implement PBC nation-wide, they should put more serious efforts to promote and socialize this new scheme to all stakeholders including convincing internal government key personnel in the Ministry of Public Works, in the Ministry of Finance, and the legislative.

Since then, the MPW have convinced the Ministry of Finance to agree on allocating four more PBC projects with 7 (seven) year contract duration. These are:

- Section Semarang-Bawen, West Java (22 kilometers), contract period: 2012-2018
- Section Bojonegoro-Padangan, East Java (11 kilometers), contract period: 2012-2018
- Section Padangan-Ngawi, East Java (10.70 kilometers), contract period: 2012-2018
- Section Sei Hanyu-Tb. Lahung, Central Kalimantan (50.60 kilometers), contract period: 2013-2020

While all pilots are situated in Java, the latter section is located in Kalimantan, an island not in Java. This decision to try a project out of Java is part of MPW’s effort to test the scheme on the stakeholders far from the nation capital. The vast geographic region of Indonesia, consists of thousands of islands, poses a unique challenge for the traditionally central-based road national asset management. Furthermore, the capacity of local construction industry is lacking. Lessons learned from such pilot project are highly anticipated. Next, the national road agency of MPW is targeting to execute longer-term contract duration to ten years for typical PBC for national road maintenance. The first two pilots in 2011 have been evaluated by the National Audit Board (i.e., BPK-RI). While they approve and are supportive of PBC trials, their recommendations include to temporarily reschedule future pilots in accordance with the requirement for MPW to put together more comprehensive legal frameworks to ensure compliance with the regulations.

3. PBC for Roads – Experiences of Australia

In the 1990’s, the New South Wales (NSW) Government started to experiment with performance based maintenance contracting (PBMC), which was designed to turn the control and responsibility of road transport maintenance, rehabilitation, and capital improvements over to private contractors [4,5]. PBMC (also referred to as performance based contract (PBC) in Australia) [6] combines “pure and hybrid” types of performance based contract to manage all categories of urban and rural road maintenance projects. The Roads and Traffic Authority (RTA) began by undertaking pilot studies of two short-term contracts in western Sydney, each of 100 kilometres (kms) that primarily focused on the determination and differences in costs, quality, and response time between the private contractor and RTA workforce [1,7]. Ref [4] asserted that the NSW pilot studies were ‘innovative’, allowing private contractors and the RTA workforce to acquire the necessary skills and understanding of PBC associated risks [8]. It was a process that led to the carrying out of detailed analyses of road networks based on features and conditions of the roads, data collation of historical work and cost, definitions and methodologies for performance measurement and reporting of maintenance and service management [4,9]. Ref [10] stated that road transport performance measurements tend to originate for a number of reasons that can be to measure the current and future conditions of road infrastructure, as well as providing an evaluation of the road authority efficiency with respect to the services provided, productivity, environment protection, and cost effectiveness of those programs.

Resulting from the success of the NSW pilot studies that generated overall cost savings of 16 per cent and productivity increases of 22 per cent, other Australian states adopted the use of performance based contract to maintain
and repair both urban and rural networks [11]. Subsequently, the NSW Government in 1995 tendered its first full PBC covering 450 kms of urban roads in Sydney [6,5], which achieved a 25 per cent lower bid price. However, in 1999 the NSW Government commenced investigations and inquiries into outsourcing and competitive tendering of road maintenance contracts, as the costs savings were in a deteriorating state affecting a number of PBC outsourced projects that were then being undertaken in the state. According to [6], the State Development Committee was established with terms of reference (ToR) to investigate the role of competitive tendering as a means to reduce the State’s road maintenance bill. In the course of the investigations, the NSW government changed the ToR and decided to keep road maintenance as the sole responsibility of RTA, but introduced sweeping changes that introduced a series of benchmarks for future road maintenance project performance. The government’s decision was attributed mainly to the fear of job losses in rural and community regions. In spite of the government’s decision to halt contracting arrangements with private contractors, NSW actually renominated one contract in Sydney’s north east sector that had been in operation for over 10 years and was worth $35 million, as performance ‘specified’ maintenance contract (PSMC) [6].

In other Australian jurisdictions, notably Western Australia (WA) and Victoria, outsourcing of road maintenance contracts has operated very successfully. WA and Tasmania adopted the whole-of state model (long-term PBC) that comprised urban and rural road networks, and Tasmania was the first state in Australia to introduce a long-term PBC [4]. In Victoria, the State road provider, VicRoads adopted a mix of in-house maintenance provider that competes alongside the private contractor for road maintenance services [6]. The in-house capability is used as a benchmark to compare the private contractor’s performance and means of incorporating performance maintenance skills lacked in-house and outsourcing delivery modes. The story is different in WA that embraced full PBC by entering into 8 performance based contracts with 10 years duration, which includes maintenance and rehabilitation services of national highways, state road networks, and local roads. Six contracts were pure PBC, while the other two are hybrids [12]. The pure PBC road lengths were 1,560 km to 4,280, while the hybrids were of shorter contracts, covering 315 km to 375 km with the imposition of an oversight authority as superintendent. The superintendent is responsible for identifying defects in works performed by the private contractor with the power to issue a rework order [13]. The short-term drivers of the PBCs described the extent of allowable road defects and response time [12]. The long-term drivers are set of conditions and attributes within the contract terms and conditions for the road user costs (roughness, surface texture, surface skid resistance and rutting) safety, and pavement life.

The difference between WA scope of work for pure PBC and [10] description ignores the cost efficiency associated with performance based contracts and serviceability of the roads. The scope of works of pure PBCs in WA was as follows: Routine and periodic maintenance; Reconstruction and rehabilitation; Emergency response; Customer relations; Collection and maintenance of asset inventory data.

In WA, these contracts (pure and hybrids) were awarded on the assumption of best value for money that attracted capable bidders on the basis of five step procurement approach such as: Pre-qualification of suitable companies based on submission and expression of interests; Maintenance contract request for proposals; Identification of the preferred bidder; Due diligence and contract negotiations; Contract award and possession of site.

Australia uses the Quality-Based Selection (QBS) method to select a winning tender bid, which takes into consideration both quality and price. The bid is separately evaluated against these two criteria and scored with weights applied to each (80:20, 60:40, etc.) and the contract is awarded to the bidder with the highest combined score. Weights, scores, criteria, and importance of their attributions to the bid are determined by the contracting agency [4,9]. The benefits that arise from QBS method of selection tend to encourage and attract mostly highly experienced contractors to tender for the contract, and in in turn, eliminate unqualified and inexperienced contractors from participating.

Drawing from the WA experience, risks allocated to the private sector included cost variations due to latent road conditions, salinity and rising water table, traffic volumes, axle loadings, selection of treatments, and the cost of any re-work required to meet agreed standards. PBC is a shift from a work output-driven vehicle to a performance specification driven type of arrangement that allocates and transfers the risk exposure associated with road maintenance from government agencies (road authority) to the private contractor. In NSW, the fundamental premise of the first PBC by RTA was that the contractor achieved specified road condition standards over the contract term, design work programs, funding, and delivered ‘whatever works’ required to achieve the stated standards [14]. It should be noted that in certain circumstances, it is highly desirable that the vesting of maintenance works remains with the government road authorities, for example, hybrid contracts or full maintenance contracts where natural disaster occurs.
and might prove difficult for the private contractor to achieve the desired outcome [6].

Various mixed procurement options have been adopted by each state in Australia that combine “pure and hybrid” performance based type contracts. Both Tasmania and WA have opted for long-term contract arrangements using PBC, the Victorian government has adopted a partial outsourcing model that allows an in-house maintenance provider to work alongside the private contractor for road maintenance services [6]. In NSW, the use of PBC has been for the time being reduced, or temporarily halted for contracting arrangements. There is one contract in operation for over 10 years now known as the performance specified maintenance contract (PBMC) worth $35 million and operating successfully in the Sydney North East Sector [6].

Whilst road maintenance contracting in Australia has produced several successful project outcomes, it has also at times been somewhat inconsistent, because of the circumstance and motives behind its introduction, which are primarily directed towards cost reductions and improvements of allocated efficiencies. The process has neither achieved the success expected or delivered the desired outcome intended, because the rationale for adopting certain types of procurement arrangements are either not well defined as they have been driven by various state governments’ financial or political necessity to reduce road maintenance costs. This public policy driver, even when attributed with best value for money in terms of cost savings, often tends to lack the wider support deserved and this has led [6] to state that some of the performance based contracts are ‘wounded back in Australia’. Road maintenance outsourcing, as with any other form of partnership between the public and private sectors, is important and designed to provide best value for money as the core element in the arrangement. However, the transfer of all risks associated with road maintenance to the private contractor may in the end be impossible or inappropriate, and can actually lead to poor outcomes, or dampen the appetite and envisaged competition for outsourcing maintenance contracts; it may even reduce incentives on the entities to be proactive and accountable. A more effective way to manage risk is to identify the nature of risks and apportion each to the entity best equipped to manage those risks effectively [6,15].

4. The Way Forward for Indonesia

Learning from Australia’s experiences, while the public seek the best value for money, but transferring all or most risks to the private contractor may be impossible or inappropriate. This is more so in the case of Indonesia. Construction firms do not have the capacity (both technical and financial) to retain high risks; furthermore, the uncertainties in Indonesian context is greater, due to high political influence in the local and national levels, and weak law enforcement. Thus, there should be more effective way to manage risk.

Other than risk management, following are the more detailed challenges. In the early stage, it was considered that the MOF was unlikely to approve funding of a multi-year maintenance contract (PBC or otherwise) until they could be convinced of the merits. Recently, this issue has been progressing, however, there are numerous detailed matters to be settled as listed in Table 1. Ref [2] identified these important items to be addressed to enable PBC to be successfully implemented in the specific context of Indonesia. After having experiences of completing trials on two sections, and continuing with four more on-going projects, the most recent state of those issues were explored and described. Recommendations for future PBC deployment nation-wide should be based on more research associated with risk allocation. This will include investigation of standard conditions of contract. Implications of the contract clauses for the risk management strategy to be adopted by contractors. Based on the nature of risks, some are best managed by the project owner. Also, it is very important that all parties involved to be open to the new rules of contract and to convince themselves about the potential increased benefits of the use of PBC. More comprehensive efforts to promote and socialize this new scheme to all stakeholders including convincing internal government key personnel in the Ministry of Public Works, in the Ministry of Finance, and the legislative.

| Identified issues needed to be settled | Current state |
|---------------------------------------|---------------|
| 1. Policy issues                      |               |

Table 1. PBC issues to be settled
Identified issues needed to be settled | Current state
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1.a. Utility services | Utility operators generally have a right to install their assets within the road reserve, however, there is no control over the quality of reinstatement. Permen PU 20/2010 ensures that such activity can only proceed with DGH authorization.
1.b. Limited access regulations | A policy with regard to the prevention of access to the road network is still not available. Such a policy requires legislative changes to enable for the removal of illegal roadside activities.
1.c. Bond requirements | Current bond provision for construction works is not suitable for the PBC maintenance contract, wherein the 4 or 7 years of maintenance activities are equivalent to a performance bond.
1.d Cost escalation | While BPS (Statistics Board) produces a cost escalation index, it does not appropriately reflect the inputs to the contract (particularly the longer term maintenance component)
1.e. Interest for late payment by client | There are no penalties for late payment from the client. The contractor needs surety of payment; international standard practice is that the interest rate is reviewed throughout the contract period and set at a percentage above the contractors’ rate of borrowing.
1.f. Reporting standards for maintenance data | As a national system for the storage of maintenance data does not exist. Such format can be supplied to PBC contractors and DGH can start collecting and storing the maintenance data.
1.g. Management systems for roadside furniture | Ministry of Communication (DepHub) is the party, not DPW, that manages the roadside furniture. These assets are not included in the PBC contracts, while they are an integral part of the networks.
2. Legislative changes required | MOF have approved several 4 and 7 years PBC contracts. A 10-year contract is now in discussion. In the long-term, approval from the legislation enabling a certain percentage of the annual road budget to be committed for PBC road maintenance.
2.a. Financial arrangements for multi-year maintenance contracts | This is a very complex issue, not just about enforcing weigh bridge stations and fining truckers. The average of 50% overload is a classic problem, trade-off between costs of trucking and road maintenance costs.
2.b. Control of overloaded vehicles | MOF have approved several 4 and 7 years PBC contracts. A 10-year contract is now in discussion. In the long-term, approval from the legislation enabling a certain percentage of the annual road budget to be committed for PBC road maintenance.
3. Contractual issues | The collection of a comprehensive set of data is necessary to: establish a benchmark of the current condition, develop/confirm key performance measures, reduce the risks to contractors and enable equitable risk sharing
3.a. Benchmark data collection | Management board members should be a senior staff from each organisation, and not those involved in the operational delivery of the contract. Operational staff may attend at times to advise the board, but they have no voting rights. Longer term, once all parties are comfortable with the way the PBC operates, introduction of a structure without a management board could be considered.
3.b. Proposed contract organizational structure | We consider that the PBC consultant should be engaged early in the next phase of the contract – namely to assist in document development, development of key performance measures and the like. In this way, the PBC consultant will be able to assimilate the ideals of the contract and more importantly will have buy-in to the contract that they will be required to supervise.
3.c. Selection of the PBC consultant | The two stage tender approach will ensure only capable tenderers’ are considered for the final tender stage. Furthermore, it will limit tendering cost for those tenderers’ who do not have a real chance of submitting a successful tender.
3.d. Tendering processes | Given that some of the road network is in a poor condition, an initial injection of capital to raise the standard of the assets to an acceptable level is considered appropriate. In addition to betterment type works, it is appropriate to include capacity improvement works into the contract such that a multi-year maintenance period is included.
3.e. Initial betterment and capacity improvement works | However, in order to maintain the focus on the maintenance activities, it is essential that the construction type activities (capacity improvements and betterments) do not dominate the value of the contract. To this end, an upper limit of 50% of the total contract price should be assigned to construction type activities.
It would also be appropriate to include into the contract betterment works that are to be completed up to 12 months before the end of the contract period. In this way, there would be an implicit 12 month maintenance period on any works completed.
Identified issues needed to be settled

3.f. Exclusion of successful contractor from future projects

In order to prevent the situation wherein the contractor who wins the initial pilot becomes dominant (through having the only experience), the contract documentation for the pilot trial should include wording to the effect that “The DGH reserves the right (at their sole discretion) to exclude the successful contractor from other PBC contracts during the term of the contract”.

Similarly, it would be prudent that in future implementations, where more than one contract is let in a year, a condition of only being able to win one package should be imposed. This condition would be revisited once a number of contractors have had a chance to gain experience in the PBC arena and a stable situation exists with open competition.

4. Key performance measures

The development of KPMs will be required early in the contract document development process. The actual KPM development should be based on the condition data obtained from the Benchmark survey.

5. Industry training and knowledge transfer needs

Industry training is likely to be required to ensure both the competitive nature of the tendering process and for the ultimate success of the pilot trial. While the World Bank 3-day training course on PBC produced by Carl Bro will cover the issues around the PBC itself, it is considered that specific training will be required on the following aspects:

6. Construction industry

Consider outsourcing of routine maintenance contracts on an “input” or “output” basis to give industry more maintenance contracting experience.

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References

[1] N. Stankevich, N. Qureshi and C. Queiroz, Performance-based Contracting for Preservation and Improvement of Road Assets, Transport Note No. TN-27, September 2005 (updated August 2009), The World Bank, Washington, D.C.
[2] Opus International Consultants Limited in association with MWH NZ, Introducing Performance Based Maintenance Contracts to Indonesia Framework Document, 2006, The World Bank.
[3] R. Wirahadikusumah, B. Susanti, B. Soemardi, and M. Sutrisno, Drivers for Increased Benefits in Performance-Based Contracts of Road Projects, Proceedings of ConCERN/ACEC 8, 4-5 November 2014, Bandung.
[4] World Bank, Performance based contracting of roads assets: Performance contracting for roads in Australia, Australia case study, 2006.
[5] Silva, M.M. and Liautaud, G., Performance-based Road Rehabilitation and Maintenance Contracts (CREMA) in Argentina—a Review of Fifteen Years of Experience (1996-2010), Transport Papers No. 36, The International Bank for Reconstruction and Development, The World Bank, Washington, DC, 2011.
[6] Infrastructure Partnerships Australia, Road maintenance options for reforms, Building Australia Together, 2011.
[7] Frost, M., & Lithgow, C, Improving quality and cutting costs through performance contracts, Australian experience. Article for the World Bank road management training seminar, 1996.
[8] Douglas-Crane, M, Performance-based maintenance contracts in Australia. Presentation for the World Bank annual road management seminar: Innovative road maintenance contracting practices, 1999.
[9] World Bank, Performance based contracting of roads assets: Performance contracting for roads in Australia, Australia case study, 2009.
[10] Haas, R., Richards, I., Raymond, C., Yeaman, J., & Falls, L, Alternative Contracting Models for Maintenance and Rehabilitation of Pavement Networks, presented at the Ninth International Conference on Asphalt Pavements, Copenhagen, Denmark, 2002, pp. 17–22.
[11] National Cooperative Highway Research Program, Performance for contracting for maintenance, A synthesis of highway practice, Transportation Research Board on National Academies, 2009.
[12] Engelke, T, An international Perspective: Long-term Performance-based Road Maintenance Contracts in Western Australia, Paper for the Bay Roads Exposed Conference, Rotorua, Main Roads Western Australia, 2003.