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Review of Performance Based Contracting in the Road Sector - Phase 1

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REVIEW OF PERFORMANCE BASED CONTRACTING IN THE ROAD SECTOR – PHASE 1

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

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GLOSSARY OF TERMS

Term	Definition
Bill of Quantities (BoQ)	Refer Input Contract
DBMOT	Design Build Maintain Operate Transfer
FIDIC	Federation of Consulting Engineers. The FIDIC acronym stands for the French version of the Federation's name (Fédération Internationale des Ingenieurs-Conseil)
Improvements	Items such as widening of roads, intersection upgrades etc. that primarily improve the functional performance of the asset. While often completed in conjunction with other works (when the existing infrastructure is due for resurfacing or renewal, they are not essential to the retention/reinstatement of the original level of service.
Input Contract	Where payment is made on the basis of the resources consumed e.g. $/m^3 of material, $/hr for labor and plant. The Contractor takes very little risk.
OBA	Output Based Aid.
OPRC	Output and Performance-Based Road Contract
Opus	Opus International Consultants Limited
Outcome Contract	Where payment is made on the basis of the quality of the asset provided e.g. $ for having the road in a specific roughness. The Contractor takes the risk on the resources, quality and quantity of work.
Output Contract	Where payment is made on the basis of the outputs delivered e.g. $/km for resurfacing, $/sq-m of patch. The Contractor takes the risk on the resources involved and the quality of work, but not the quantity of work.
Pavement Renewals (Reconstruction or Rehabilitation)	The improvement (reinstatement) of the load carrying capacity of the pavement layers
PBC	Performance Based Contracting
Periodic Maintenance	Refer Periodic Resurfacing
Periodic Resurfacing	The planned resurfacing of a road and for unpaved networks the scheduled addition of more gravel on the wearing course to account for that lost under vehicle usage. For asphalt surfaced pavements, overlays less than 50mm are considered as resurfacing
PMMR	Performance-Based Management and Maintenance of Roads
PPIAF	PPIAF (Public-Private Infrastructure Advisory Facility) was created in 1999 to act as a catalyst to increase private sector

Term	Definition
	participation in emerging markets. It provides technical assistance to governments to support the creation of a sound enabling environment for the provision of basic infrastructure services by the private sector. PPIAF's mission is to help eliminate poverty and achieve sustainable development through public-private partnerships in infrastructure. Projects can be submitted, approved, and implemented in 12 weeks. refer to http://www.ppiaf.org/ppiaf/
PPP or P3	Public-Private-Partnership
Reactive Maintenance	The routine, typically reactive, actions needed to restore network safety/serviceability. Involves items such as pothole repairs, vegetation control, drain clearing etc.
VfM	Value for Money

1 EXECUTIVE SUMMARY

Performance Based Contracts (PBC's) are not new to the transport sector, with many variants in use in different countries for close to two decades. International lending institutions – such as the World Bank – have played a significant role in pushing PBCs into developing nations as part of loan assistance packages.

However, there has been a tendency for a "one-size-fits-all" approach to the implementation, with the result being a variation in the success of any implemented PBCs, as well as a significant proportion of the proposed PBCs not making it to the contract award stage. To address these issues, the World Bank has commissioned a Review of Performance Based Contracting in the Road Sector (contract number 7158253) led by Opus International Consultants Limited.

The project is in two phases:

- Phase 1: Being about reviewing projects to determine what makes projects succeed; and
- Phase 2: Being the development of better guidance on the selection of the appropriate PBC for given situations.

Phase 1 consisted of 6 tasks as follows.

Task 1: Taking Stock of Various Types of PBC Projects

To arrive at the findings within this Phase 1 report, the project team undertook an international review of various PBC projects in both developed and developing nations, including many that had failed to reach the point of signing the final contract. The review consisted of literature reviews, surveys and phone interviews for some 35 projects. This was further supported by the authors own experience on a variety of PBC contracts around the world.

At the outset, the methodology was based around the expectation that the vast majority of projects identified for interview would have reached completion and the questionnaire was produced on the basis of identifying the minor variations that made one contract more (or less) successful than the next. However this was not found to be the case, and in discussions with the various team leaders it became apparent that often the major challenges occurred in getting the PBC contract in place.

This task also identified that there is a need to separate out the benefits of implementing asset management (for which PBC is a good facilitator), to that of the actual benefits of delivery of the physical works by PBC. While many projects may not have reached the stage of awarding a PBC contract, the benefits of

understanding the assets, levels of service, risk and long term costs are significant in their own right.

Similarly the need to understand and apportion risk (including the definition of appropriate risk boundaries) is essential to both asset management and to the ultimate success of any resulting PBC.

Task 2: Defining various types of PBC methodologies

This task set out to define the many different PBC methodologies that are in use today. The review identified in excess of 15 variations (by name or detail) of PBCs. Furthermore, it identified that the term Output and Performance-based Road Contracts (OPRC) is used varyingly as both an umbrella term for PBCs and as a specific contract form (as a result of the Banks sample bidding document). The task concluded that PBC is the overall umbrella term for a range of contracts ranging from design-build, through to public-private-partnerships. Furthermore, the term OPRC should be considered the over-arching umbrella term for contracts involving the long term management of road networks, with three variations based on the state of the road network:

- Network Management: Where the road network is in stable condition, with elements of the network at all stages of the life cycle, the focus becomes on the delivery of maintenance and renewals with a notionally uniform level of work. There is no specific need for a significant upfront investment, and the aim is to deliver the levels-of-serve at least of whole-life cost;

- Design, Build, Maintain, Operate and Transfer (DBMOT): Where the road network requires a significant initial investment to bring it up to an acceptable condition, then the DBMOT model is appropriate. This situation is often associated with a history of poor construction quality and the focus is to get a better life from the assets being built, rather than necessarily delivering least whole of life costs. For that reason the renewal and rehabilitation works are often brought forward to the start of the contract, with the remainder used as a maintenance period to incentivize the contractor to improve quality standards; and

- Unpaved Roads: OPRCs have often delivered the greatest benefits for unpaved networks – particularly with respect to the social benefits of gaining all-weather access for remote communities to social services and to markets for their goods. While typically a variant of either the Network Management or DBMOT models, the rapid change in the condition of unpaved networks, the different risk models, and the lower cost to enter the market for contractors, all make for unpaved road networks to warrant their own category of OPRC.

An additional variation is for those networks needing significant investment in improvements and additional funding from the private sector - Public-Private-

Partnerships, Toll roads and the like. These are in many ways extreme examples of the DBMOT model, and are not addressed in further detail within this study. Similarly pure Design-Build contracts are also outside the scope of this study.

This task also sought to understand the selection criteria for each of the above contract models, with the prior thought being that it would be possible to say that "if a, b and c exist, then use x etc.". In practice, the study has identified that it is the network condition and associated aspects that determine which contract model is best, rather than specific items such as an ability to deal with corruption, driver of innovation etc.

Task 3: Outlining PBC's strengths and weaknesses

Distinguishing between the strengths and weaknesses of PBCs, as opposed to those of implementing good asset management, was much harder than expected. However there were consistent themes that emerged from the review, including the fact that OPRC (when supported by good asset management practices) consistently deliver:

- Improved workmanship, as a result of the contractor being financially liable for defects;
- A more consistent level of service being delivered to the road service, and road users becoming more aware of what they can reasonably expect;
- Less corruption as a result of their being far fewer financial transactions, in conjunction with the above comment on levels of service; and
- A better focus on innovation and the sharing of risk.

The task also identified that there are a number of pre-requisites to the successful implementation of an OPRC, including a strong governance model and buy-in to both asset management and OPRC objectives by the client.

Task 4: Clarifying both various types of PBCs and FIDIC-type (Input/Bill of Quantities) contracts

This task examined the three OPRC contract forms noted in Task 2 (Network Management, DBMOT and Unpaved) alongside the FIDIC Input and Output forms of contract. The work did not identify specific factors or situations that would lead to one form of contract over another beyond those implicit in the contract form. For instance, if the network was in a state of poor repair, and funds were short, then a DBMOT contract would be suitable. If the same network existed, but funds were plentiful and quality of workmanship was not an issue, then an Output form of contract might be suitable to bring the network up to standard before implementing a Network Management contract.

What was concluded is that where asset management is well understood by both the client and the supply chain (consultants and contractors), there tends to be a greater use of outcome payment options, while the converse is true in terms of the use of input methods. In other words, to be able to both manage and supply an OPRC, asset management is a core prerequisite – and once asset management is in place the movement to an outcome based contract (and away from input/output) appears inevitable.

Task 5: Discriminating between successful and less successful factors of PBC projects

Task 5 was initially expected to determine what makes one PBC more successful than another. However the research rapidly identified that the issue was more around "why do many potential PBCs never make it to the start line?" rather than "how well do they do once in place?" This lead the team to identify seven steps (from the client have an idea, through to the PBC being delivered) where the PBC Implementation Chain can fail.

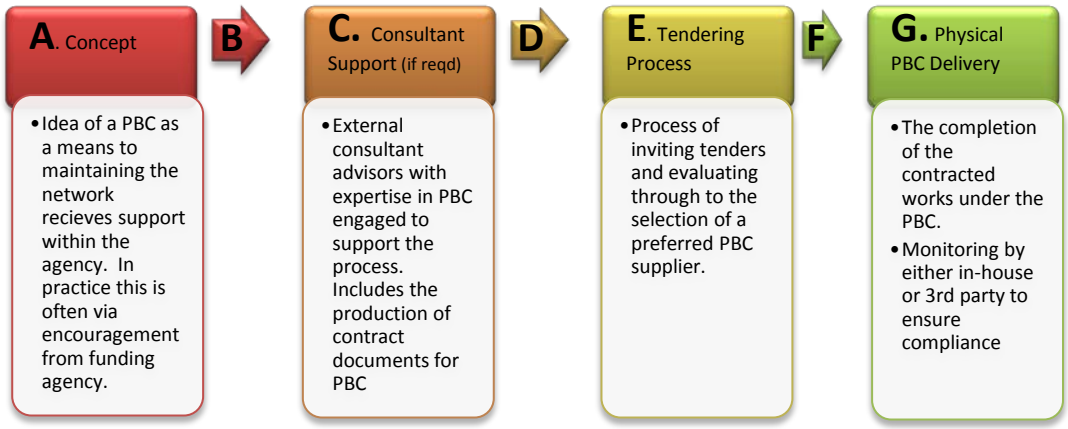

FIGURE 1: PBC IMPLEMENTATION CHAIN

This task also identified that focusing on the successful delivery of a PBC as the outcome, and that anything less is a total failure, is not appropriate. Again, linked to the significant benefits of implementing asset management, it is identified that the benefits gained in progressing towards a PBC are significant in their own right, and that the actual procurement of the PBC is in many cases the "icing on the cake".

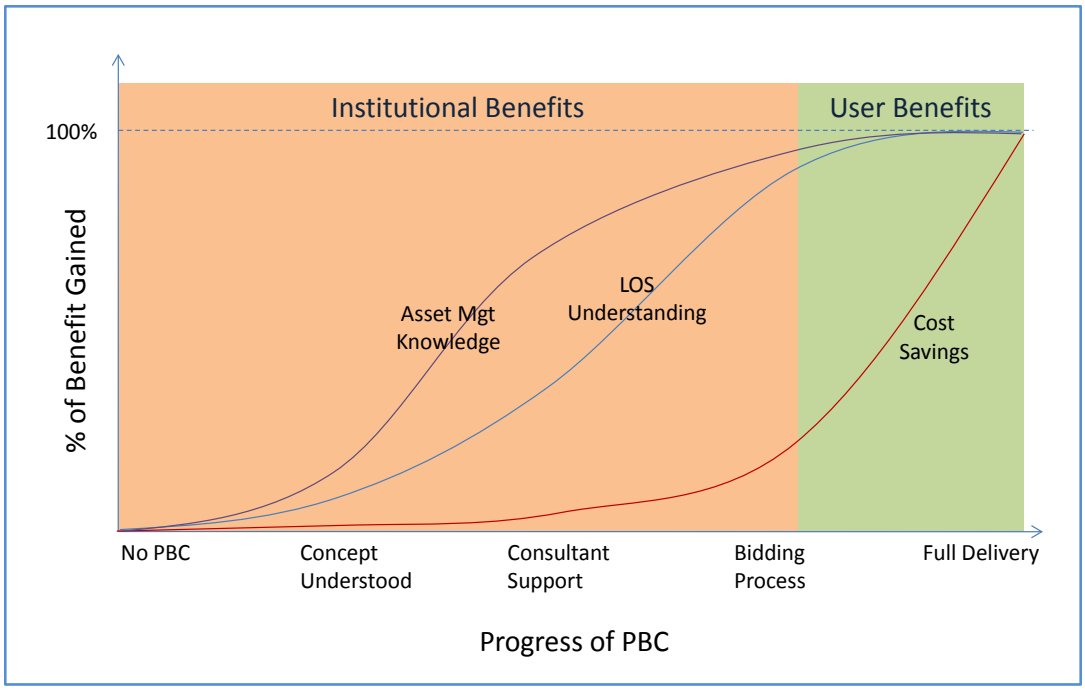

FIGURE 2: BENEFIT REALIZATION

To assist in a greater number of projects making it to the delivery phase, it is concluded that the focus of the consultant support role should be:

1. Assist in building understanding of asset management within the client
2. Development of an asset management plan, to identify risks, levels of service, long term demands, etc.
3. Prepare a procurement plan (including OPRC and non-OPRC options) for the physical delivery of the works necessary to meet the requirements outlined in the AMP
4. And only then, should the focus move on to facilitating the implementation of an OPRC.

Such a model is illustrated within the figure below. While the completion of the AMP is suggested for all roads managed by the road agency (such that whole network service levels can be set), at a minimum the AMP should be completed for the roads within the proposed PBC contract area.

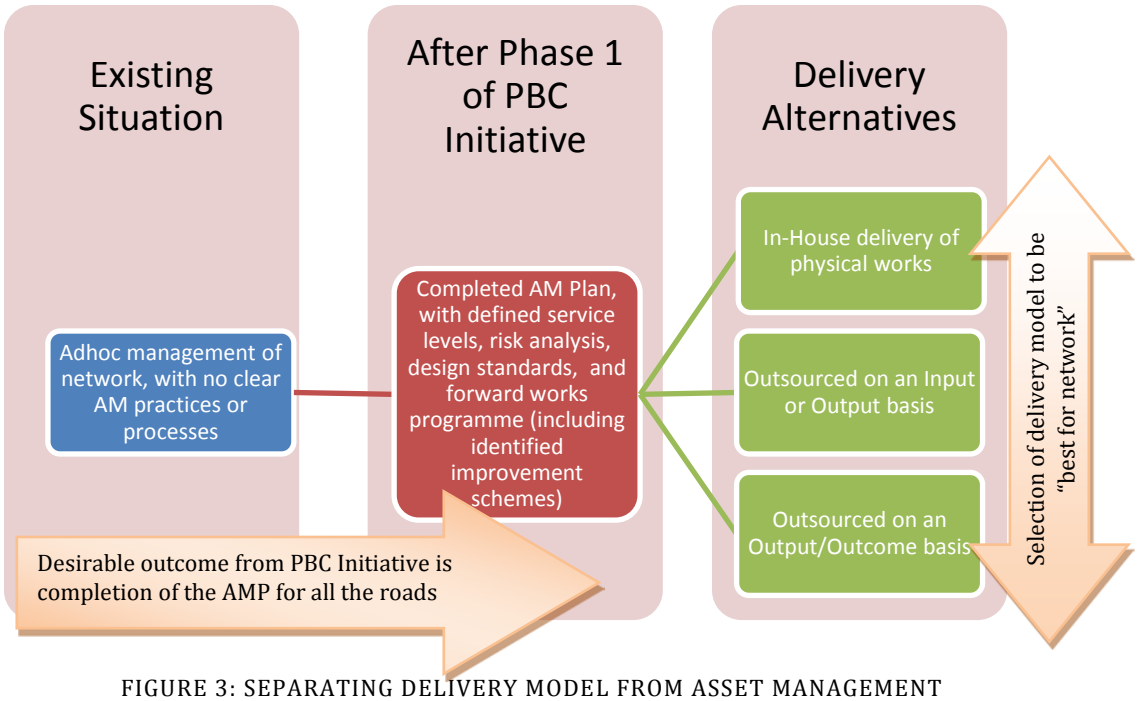

FIGURE 3: SEPARATING DELIVERY MODEL FROM ASSET MANAGEMENT

By not pre-ordaining the outcome of the entire process of being one of "PBC must occur" to instead being one of "asset management must occur, PBC may be a good support tool that will be examined at some stage" it is anticipated that the level of apathy towards PBC could be greatly reduced, as asset management does not in its own right require that PBC is the outcome.

Task 6: Developing a work program on how to move the second phase forward

For the next phase of this project, work activities have been focused on both improving the outcomes of those projects that make it to implementation, and also to getting a greater portion of the projects from Concept to Implementation. The Phase 2 work plan is presented in Table 1.

TABLE 1: PHASE 2 WORK PROGRAM (REPEAT OF TABLE 10)

LINK IN IMPLEMENTATION CHAIN	Proposed Work for Phase 2	Proposed Work Post Phase 2
A. Concept	Develop better Bank guidance on the benefits of an asset management approach and a full suite of PBC methods available, including a clear selection criteria for each model type and some factually based analyses of the value delivered by the PBC model.	

LINK IN IMPLEMENTATION CHAIN	Proposed Work for Phase 2	Proposed Work Post Phase 2
Concept (con'td)	This would involve expansion of the decision tree (Figure 32) for selecting contract model types and for progressing through the Implementation Chain. This would be in the form of a guide, transport note and a Bank strategy on PBCs (promotion of AM, different contract types, etc.). [Note: This equates to Tasks 7 & 8 of the Inception Report] Refinement of the Bank Resource Guide, with the referencing of the materials to each of the model forms and the link in the Implementation Chain that they pertain to. Review of the existing training materials and development of proposal to amend/update/expand. [Note: This is Task 9 of the Inception Report]	
B. Move from Concept to Consultant Support		Develop a sample Terms of Reference for the consultant support to suit the case at hand. The TOR should require for the delivery of a draft Asset Management Plan that would provide a benchmark cost comparison for whatever form of PBC was subsequently decided upon.
C. Consultant Support		Provide asset management plan template for completion by the Consultant as a first deliverable.
D. Progression to the Bidding Process		Develop templates for determining the financial model leading to a payment model. Develop a sample risk allocation table.

LINK IN IMPLEMENTATION CHAIN	Proposed Work for Phase 2	Proposed Work Post Phase 2
E. Bidding Process		Develop a suite of sample OPRC contract specifications for each of the contract types (Network Management and Unpaved Roads).
F. Signing of the PBC Contract		Develop a sample terms of reference for the engagement of a consultant to support the contract once implemented.

Overall Conclusions from Phase 1

Bringing together the findings from Tasks 1-6, the study team has concluded that:

1. There are four primary scenarios under which PBCs are used for road networks:

    a. Generally a poor condition – typically a Design Build Maintain Operate Transfer (DBMOT) model form;

    b. Generally good condition – a network management contract;

    c. Unpaved roads – a variation of either of the above but with specific variations to address the different performance and life cycles; and

    d. Networks needing significant investment in improvements and additional funding from the private sector - Public-Private-Partnerships, Toll roads and the like.

2. Many of the benefits of implementing a PBC are directly aligned to the benefits associated with good asset management, and it may be better to position PBC as a facilitator of good asset management, rather than a goal in its own right;

3. A sound understanding of risk, the allocation of risk and the definition of risk boundaries is essential to both asset management and the identification of the benefits of one contract model over another.

4. Very few PBCs fail once implemented (although not all deliver the full benefits initially realized). Most "failures" of PBC are actually situations where the implementation did not occur at all. Even where implementation did not occur, there are potentially significant benefits to be gained from the prior steps – such as the definition of levels of service, understanding of the necessary funding levels to deliver least whole-of-life cost solutions etc.;

5. To make it through the full PBC process, the project requires strong champions in the road agency, the ministry of finance and the Bank (or other lending institution);

6. The term OPRC has a confused usage within the Bank and industry, with it both being a specific contract form (aka aligns to the sample OPRC bidding documents) but is also used as an overarching "umbrella" term to describe PBCs. In practice PBC is the overall term for all performance based contracts, while OPRC pertains to the performance based contracting in the road sector where significant maintenance periods are involved.

7. The existing sample OPRC bidding documents seldom get used without substantial change to accommodate the four situations noted above. This then results in an extension of the time required for the procurement process, often with an associated loss of interest from all parties – increasing the chance of the PBC not progressing to implementation;

8. Procurement of PBC – both for consultant support and the physical works – on a lowest price basis is not in the best interest of the PBC in any country where PBC (and asset management) experience is not well developed. The chances of successfully making it to the implementation stage (and with the correct PBC model in place) is greatly enhanced where experienced support is engaged;

9. Road Authorities often struggle to recognize the value-for-money (VfM) PBCs [and good Asset Management] have to offer. This is understood to be primarily as a result of the PBC often addressing issues of under-investment, poor quality workmanship, risk management, varying levels of service etc., which can make the PBC appear expensive when compared to the historic method of maintaining the network. There is a need for better guidance on how to determine the VfM argument for the PBC. Furthermore, there would be benefit in identifying the levels of service (the value) that can be delivered via the PBC model for the current funding regime to provide a comparison/justification for the funding level recommended in the PBC.

10. PBCs offer a procurement model that is more resistant to corruption than traditional input/output contracting. This is for two primary reasons:

    a. There are fewer transactions involved, such that auditing is much easier;

    b. The levels of service can be made public and defined in such a way that the motoring public is able to identify if contractual compliance is being met.

11. The retention of asset value is a key challenge. Reliance solely on FWD results is not considered prudent as variability in test results can be significant. The use of underpinned quantities of work, with an associated quality control regime, to ensure the asset load carrying capacity is managed appropriately is a widely used best practice to support the FWD testing/analysis regime.

12. The project has identified the concept of a PBC Implementation Chain that identifies the seven steps that any PBC must traverse in order to make it to the "implemented" stage. This is an important aspect to understand, as success (and failure) can occur at any link in the chain. It is also important to understand that some benefits can be gained at each link in the chain, and that even when the final implementation stage is not reached, that a great number of benefits can be realized for both the network under investigation, and the wider network managed by the road agency.

2 INTRODUCTION

2.1 CONTRACTUAL ARRANGEMENTS

The World Bank has commissioned a Review of Performance Based Contracting in the Road Sector (contract number 7158253). The review has been awarded to Opus International Consultants Ltd (Opus) in conjunction with Dr. Theuns Henning of the University of Auckland and Dr. Gerardo Flintsch of Virginia Tech with the overall Team Structure as per Figure 4.

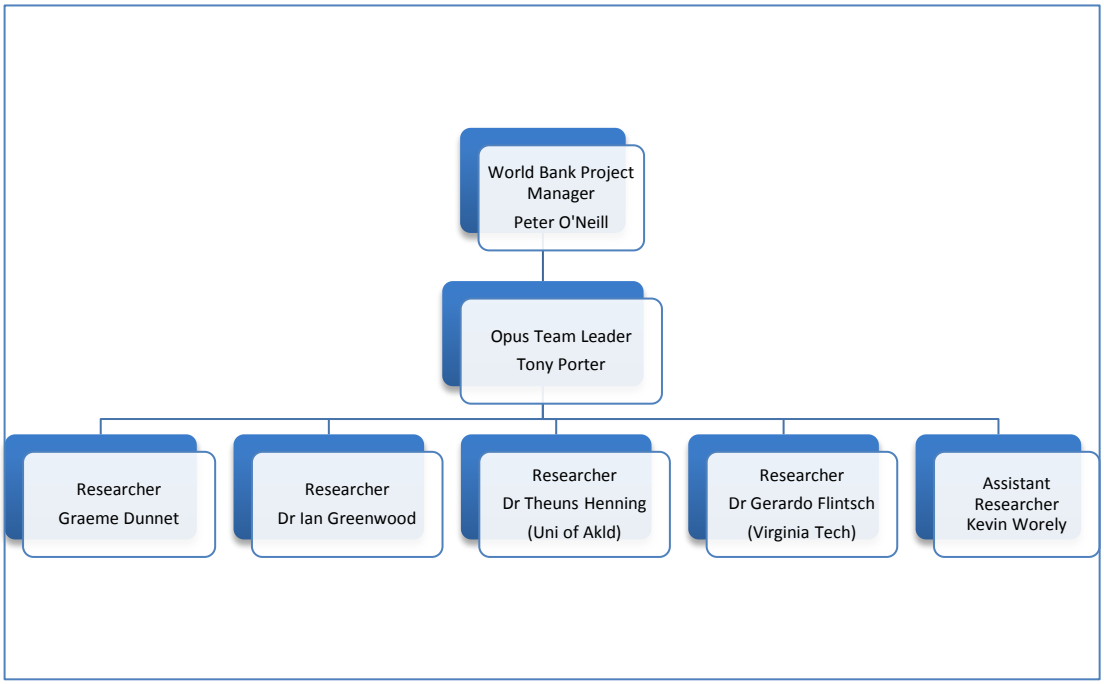

FIGURE 4: REVIEW TEAM STRUCTURE

2.2 BACKGROUND TO ASSIGNMENT

2.2.1 ABOUT PBC

Performance-based contracting (PBC) is defined as "a type of contract in which payment for the deliverable is explicitly linked to the contractor's successfully meeting or exceeding certain clearly defined performance indicators". PBC involves a significant shift away from more traditional approaches to the delivery and maintenance of road infrastructure and associated services by departing from the

client's having responsibility for the design and supervision of construction and maintenance activities, to focus upon the key outcomes that the client wishes to achieve. Most PBC's consist of a subset of the following six components: design, build, finance, operate, maintain, and transfer.

The World Bank (Bank) has supported different types of PBCs in the road sector over the last 15 years. The Bank developed sample bidding documents for PBC in 2002 (Performance-based management and maintenance of roads - PMMR[1]), and again in 2006 (Output- and Performance- based Road Contracts - OPRC[2]) to secure minimum standards of quality for PBC implementation. Also, the Bank published Transport Note No.27[1] in 2005 and a supporting web based Resource Guide[3] in 2006, to assist national and sub-national road agencies launching or enhancing PBC projects for constructing, operating and maintaining their road networks.

There are, however, a wide range of perceptions and expectations by the Bank's staff, its clients, their consultants and contractors of what a PBC really is, what it may achieve, and what elements need to be present to increase the likelihood of success, including realistic affordability. Due to an increase in the number of PBC projects and the evolution of PBC methodologies, the Bank needs to consolidate its policies and practice in this area. The clients of the Bank and other development banks have looked to the Bank for advice and suggestions on the appropriateness and advantages of using a PBC approach. PBC projects, however, are being advised by the Bank's staff that may not have extensive PBC knowledge and experience and require guidelines and contracting tools. The Bank's staff, in designing PBC projects, may also be adopting a variety of approaches that are not necessarily internally consistent, or necessarily applying the best PBC approach for a given network/agency situation.

2.3 WHY ARE AGENCIES LOOKING TO PBC'S?

While there are many reasons given for implementing a PBC, these can be generalized into the following categories:

- Providing a better client side focus on governance;
- Delivering a more consistent (and/or better) service level;
- Reducing costs and/or setting costs at a fixed level to enable for long term fiscal planning by the road agency;

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[1] World Bank (2002). "Sample Bidding Document: Procurement of Performance-Based Management and Maintenance of Roads (Output-based Service Contract)". Washington, D.C. February 2002.

[2] World Bank (2006). "Sample Bidding Document: Procurement of works and Services under Output- and Performance-based Road Contracts and sample specifications". Washington, D.C. October 2006.

[3] Stankevich, N., Qureshi, N. & Queiroz, C. (2006). "Performance-based Contracting for Preservation and Improvement of Road Asset." Resource Guide.

- Better allocation of risk; and
- Improving workmanship
- Addressing internal labor shortages wherein the authority may not have the internal resources/capacity to manage a network according to the traditional model.

It is worth noting that this list is very similar to the drivers for improving asset management. As is noted later in this report, there are significant asset management benefits to be gained from working through the process of implementing PBC, even if the actual PBC never eventuates.

While many of these desired outcomes might be achieved via alternative contracting means, it is the PBCs requirement to address all of these at once that is often perceived as the key benefit to the contract model as they force a paradigm shift and consideration of all the principles of good asset management.

While the nature of this report is focused on PBCs, in many cases the benefits can be ascribed to the fostering of an improved asset management understanding that is a necessary prerequisite for a successful PBC. It is quite possible that the PBC model should be positioned as an enabler/facilitator of good asset management, rather than an end goal in its own right.

2.3.1 PBC MODEL TYPES

The term PBC represents a spectrum of contract models, with variations resulting from the scope of assets included, the nature/condition of the existing road network, and the payment mechanism to name but a few.

The key situations and intents of the resultant PBC are:

- Unpaved roads: Owing to their relatively fast deterioration the outcomes are generally easy to specify and are focused on the road user comfort measures. While there is an issue around the specification of appropriate durability measures for unpaved roads to account for gravel loss, they have been successfully implemented in a number of countries. Given the performance indicators change quite quickly on unpaved roads (both in terms of deterioration and rectification (via grading)); this has to be considered when evaluating the performance and contractual compliance.
- Paved roads in a generally poor-fair condition (DBMOT PBC): With these roads the focus within the PBC needs to move from the initial upgrading of the network, through to the maintenance of the network. The form of the payment mechanism needs careful examination to ensure that the contractor is suitably incentivized to

deliver on the maintenance portion of the contract. The focus on these contracts is often to get improved construction quality (often at the expense of whole-of-life-cost [4] initiatives), with a key requirement being a sufficient period of time post construction for any defects to be rectified by, and at the cost of the contractor. For example, the CREMA (Rehabilitation and Maintenance Contracts) contracts used in Latin America include a heavy initial rehabilitation. These contracts are often referred to as Design-Built-Maintain-Operate-Transfer (DBMOT) contracts. Design-Build only contracts, while performance based, are outside the scope of this project which is focused on models that include the ongoing maintenance of the network.

- Paved roads in a generally good-excellent condition (Network Management PBC): These roads require a relatively small (if any) initial investment to bring the network into full compliance with the required service levels. The focus is to obtain the least whole of life costs (often akin to maximizing the asset life) from the assets under management whilst also ensuring an appropriate condition at the end of the contract term (i.e. ensuring the asset is not unduly consumed over the term of the contract). With these networks the payment is typically a uniform amount per month, and the focus is on a long term sustainable service levels (both during and after the contract period) which typically demand a relatively uniform series of interventions. It is under this scenario that the Bank standard OPRC documents were originally prepared with a nominal upfront investment limit of 30% of the total contract value being placed on the applicability of the document [This requirement was subsequently removed so the documents could find wider use]. These contracts are typically of a performance based Network Management Contract [5] form, and it is likely that a sound understanding of asset management would be required to deliver the

[4] Whole-of-life costing involves the minimization of the cost of ownership of the assets over the life of the asset. It includes for the analysis of investing more today, in order to deliver savings tomorrow, as well as extracting the full life from the asset. In many contracts where there is a history of poor construction quality, the remaining life of the asset is "discarded" in order to provide a works programme that is completed in the first 1-2years of the contract, with the remaining period used as a maintenance period to drive better construction quality.

[5] These contracts recognize that at any point in time there is likely to be parts of the network with a range of ages and residual lives, and that the focus is on a consistent service level and minimizing the whole-of-life costs. This is distinct from the DBMOT approach that typically sets out to provide a step-change in service levels and mitigate the risks of poor construction quality via the extensive upfront work.

timely interventions and good workmanship needed to deliver the specified service level for the least cost.

- Partially or fully privately funded roads: Where there is a major capital investment required (typically the addition of capacity rather than improvement of condition), accessing private funds and skills via some form of public-private-partnership (PPP or P3) may be considered. This study has considered PPP projects to identify learnings applicable to the range of PBCs, but has not undertaken a detailed analysis of the contract model (or the use of tolls to pay for the PBC).

- While all PBCs rely on a public-private partnership to some extent, it is the level of private financing in the PPP model that sets it apart. In practice the PPP model tends to be an extreme application of the DBMOT model, wherein with the PPP the client pays for the initial upgrade component over a much longer time period (potentially the whole contract period which are typically 30years in duration), or tolls are collected over the term of the concession as a means of reimbursement / payment, rather than on an output/outcome basis as is common under a DBMOT model.

In practice, all contractual models require partnerships to be successful and the learnings within this report are in most cases, applicable to all models. It is worth noting that there is a strong tendency for the projects that are funded by the Bank and other lending institutions to fall into the DBMOT category. This is thought to be because those countries where investment is sought by way of Bank loans to improve the infrastructure have typically a poorer standard of road network (often owing to insufficient funds). This is in contrast to the OPRC standard bidding documents that were developed with a more balanced asset management approach in mind.

2.3.2 BASIC DEFINITIONS

PBCs are rife with jargon that uses different terms for essentially the same meaning in different countries, and different meanings for the same term in different countries. The following definitions are used throughout this report:

- Reactive Maintenance: The routine, typically reactive, actions needed to restore network safety/serviceability. Involves items such as pothole repairs, vegetation control, drain clearing etc.;

- Periodic Resurfacing (Periodic Maintenance): The planned resurfacing of a road and for unpaved networks the scheduled addition of more gravel on the wearing course to account for that lost under vehicle usage. For asphalt surfaced pavements, overlays less than 50mm are considered as resurfacing;

- Pavement Renewals (Reconstruction or Rehabilitation): The improvement (reinstatement) of the load carrying capacity of the pavement layers and/or changing of the road prism; and

- Improvements: Items such as widening of roads, intersection upgrades etc. that primarily improve the functional performance of the asset. While often completed in conjunction with other works (when the existing infrastructure is due for resurfacing or renewal, they are not essential to the retention/reinstatement of the original level of service.)

2.3.3 ROAD NETWORKS

For the purpose of this report, road networks have been classified into two primary groupings of:

- Corridor: Wherein the assets consist primarily of a single route, with a consistent level of service ; and

- Network: Wherein the assets consist of a number of routes/roads that are ideally inter-linked to provide efficiency delivery of services but typically with varying levels of service associated with changing patterns of usage [e.g. traffic volumes, percentage of heavy vehicles etc.].

Along with the condition of the network, the form of the network impacts on the complexity of the overall PBC model as indicated in Table 2. Although it may appear surprising at first that a network in good condition is more complex than a network in bad condition, this is because a network in bad condition typically results in a "*fix it up then maintain it*" approach, which implicitly addresses all historic construction issues and risks.

TABLE 2: COMPLEXITY MATRIX

Network Type	Bad	Good
Network	Moderate	More Complex
Corridor	Simple	Moderate

Current Network Condition

While the complexity of the network is a function of the form and condition of the roads in it, the size of the network also plays a key role in determining the efficiency of the contractors operations. Ideally the combination of network form, condition and size should target to keep the routine maintenance crew productive for at least 90+% of their time, so the fixed costs of plant and labor are optimized.

2.3.4 FUNDING ARRANGEMENTS

There is a secondary discussion around the funding arrangements for a PBC (or any) contract model. The funding arrangements are important in so far as they can impact on the viability of the PBC, but are not the focus of this study. As illustrated within Figure 5, there is a circular interconnection between the financing of the project, and the work to be completed, with any constraints on funding likely to impact on the technical requirements, and ultimately on the condition of the road network.

Under a network management style contract, where the workload is notionally more consistent, the focus is on understanding the technical requirements, condition of the network and associated quantum of work required to deliver the service levels (the blue aspects of Figure 5). For PBCs, understanding the cost of service (the red squares) and the associated level of service enables for the embedment of the service requirement into the technical requirements. For DBMOT and PPP style contracts, there is a significant focus on the three red boxes associated with payment models and funding. Furthermore, the long term financial commitment required for the delivery of DBMOT or PPP style contracts typically requires some form of Ministry of Finance endorsement.

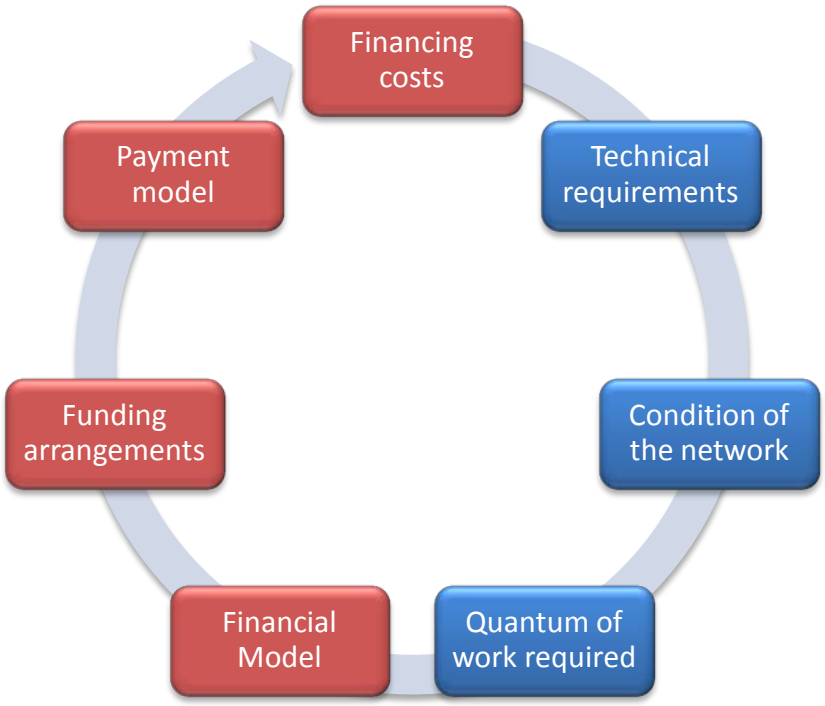


FIGURE 5: LINKAGE BETWEEN FUNDING AND TECHNICAL ISSUES

Where the Bank is providing funds to the road authority procuring the PBC, this typically adds confidence to those bidding in markets where the risk of receiving payment may otherwise be high. Where the term of the Bank loan to the road

authority does not extend to the term of the PBC, then there is a residual risk present that the contractor must address in their pricing.

Although not addressed in this report, the establishment of a Road Fund to provide a more uniform level of funding for all road maintenance and renewals projects can assist in the defining of a financially sustainable level of service for the road network.

2.4 OBJECTIVES OF THIS REVIEW

There are two objectives for this study including:

- Objective 1: To produce a strategy that would guide the WB's future engagements in PBC projects.
- Objective 2: To improve the WB's service to clients by offering a variety of PBC options, to suit different operating conditions and client needs.

2.4.1 METHODOLOGY

The project consists of two phases and multiple tasks as detailed below:

- **Phase 1: Review and Synthesis of Existing Practices**
  - Task 1: Taking stock of various types of PBC projects;
  - Task 2: Defining various types of PBC methodologies;
  - Task 3: Outlining PBC's strengths and weaknesses;
  - Task 4: Clarifying both various types of PBCs and FIDIC-type (Input/Bill of Quantities) contracts;
  - Task 5: Discriminating between successful and less successful factors of PBC projects;
  - Task 6: Developing a work program on how to move the second phase forward; and
  - Task x: Presentation of the outcomes of Phase 1
- **Phase 2: Development of a strategy, practice guidelines and model bidding documents**
  - Task 7: Developing a report to guide future engagement in PBC projects and a Transport note summarizing key messages of the report;

- Task 8: Producing a WB Strategy on contracting and Policy of PBCs;
- Task 9: Review and making proposals of the training materials and knowledge management; and
- Task x: Disseminating the outputs of the first and second phase.

This report presents the findings from Phase 1 of the project. Further detail on each of the tasks is presented within the chapters of this report.

3 TASK 1: TAKING STOCK OF VARIOUS TYPO OF PBC PROJECTS

3.1 BACKGOURND TO TASK

Given that the success of Phase 1 is dependent on the identification and review of an appropriate cross-section of contracts within this task, it was imperative that the projects reviewed covered the range of conditions that could reasonably be encountered by Bank staff. The full listing of projects reviewed is presented in Appendix A.

Table 3 below provides a summary of the 35 projects reviewed against the geographic region, how the project was funded (Bank or other) and the implementation status. The implementation status of "Not Implemented" only identifies those projects where a decision was made not to progress – many of the projects listed as "Implemented" are still proceeding through to implementation, or have only been running for a short period of time. The questionnaire (refer to Appendix B) was developed by study team and supplied to the project referees prior to contacting either via telephone (for the vast majority) or one-on-one interviews.

TABLE 3: CONTRACTS REVIEWED

Geographic Area	World Bank Funded			Other Funding			Total
	Implemented	Not Implemented	Total	Implemented	Not Implemented	Total	
Australasia	0	0	0	8	0	8	**8**
Africa	6	0	6	1	0	1	**7**
South America	10	0	10	0	0	0	**10**
North America	0	0	0	0	0	0	**0**
Europe	0	3	3	0	0	0	**3**
South East Asia	4	2	6	1	0	1	**7**
Total	**21**	**5**	**25**	**10**	**0**	**10**	**35**

Appendix C contains pen portraits of the projects reviewed, with the information summarizing key points from the total questionnaires.

3.2 CHALLENGES ENCONTERED

While the project has succeeded in addressing the tasks required, there were a number of challenges in addressing the project outcomes via the agreed

methodology. More specifically, the following challenges were encountered in completing this stock taking task:

1. In none of the projects reviewed, was there data available on both the before and after situation with regard to costs and level of service that enabled for any form of quantitative analysis. In the vast majority of the projects reviewed, the level of service and associated level of investment anecdotally increased significantly under the PBC to address a previously underperforming road network (often as a result of insufficient funding).
2. Many Task Team Leaders (TTLs) have moved on (or come into) the project and do not have a detailed knowledge of both the intent and the reality of the project.
3. Our mindset at the outset of the project was that the vast majority of projects had made it through to completion and that the project would be focusing on the fine tuning of PBC practices to make them more successful. This turned out to not be the situation, with:
    a. Many of the projects have not been underway for a sufficient period of time to gauge their success against the original objectives;
    b. Many of the projects did not make it (or have not made it) to the point of commencement, such that success in terms of the delivery of the contract cannot be assessed; and
    c. Much of the questionnaire was found to be inappropriate to projects that have not progressed into the delivery phase. However it did provide a very good platform to draw out the issues for the subsequent interviews. Given that many of the issues have found to be in the process of getting to the stage of implementing PBCs, rather than with the contract itself, a questionnaire that was aligned to the PBC Implementation Chain (refer to Figure 30) may have proved even more useful.

Despite these challenges, the project team was able to gain a wide variety and depth of feedback on the projects. In particular, the team was able to identify the key steps in implementing a PBC and what the key success factors for each step of the journey are. In addition to that, given that a large number of unsuccessful PBC projects are those one's that never got off the ground, the focus of this project has shifted to also address these issues.

3.3 LITERATURE REVIEW

3.3.1 PURPOSE AND SCOPE OF THE LITERATURE REVIEW

Given that performance based contracting for road maintenance has been in operation for almost two decades, it is understandable that the literature on this topic is vast and covers a range of aspects. The main purpose of this literature review is the focus on the objective and scope of this project, namely focusing mostly on factors that either assisted in a successful outcome of the PBC, or factors/barriers that resulted in less desirable outcomes or even where the PBC projects never materialized.

Main areas covered through the literature include:

- Understanding ways to measure the success claimed by PBC;
- Linking network or agency objectives to the PBC contract;
- Institutional issues associated with PBC contracts;
- Understanding relationship issues related to the contract; and
- Dealing with risks through the contract format.

3.3.2 WHEN IS A PBC CONTRACT SUCCESSFUL?

The Oxford Advanced Learner's Dictionary (Cowie and Hornby, 1989) defines success as "*achieving your aims or what was intended*". Herein lays one of the main misconceptions about PBCs – that is that some people are under the impression that PBCs have to result in cost savings or PBC have to result in better condition of the network in order to be a success. A PBC is undertaken with specific objectives and, if it fulfills these objectives, it is successful. For instance a PBC that aims to reduce the agency's risk profile and reduce whole-of-life costs, may indeed result in a substantial cost increase in the initial years of the PBC with little (if any) discernible change in the condition of the network.

An aspect that causes further confusion is that the objectives for adopting a PBC in the first place are not always that well understood or realized within the contract. This is often as a result of there being several years between the identification of a need/desire for a PBC, and the actual contract document being developed. Therefore measuring its success retrospectively could be difficult and not always a true reflection of the intent at the outset of the PBC implementation. The subsequent sections explore the perception of successful PBCs in more detail.

3.3.3 REPORTED ADVANTAGES AND DISADVANTAGES

Many documents describing PBC contracts list a number of advantages/benefits and disadvantages. Some examples of common points listed are (Hyman, 2009; Europe Aid and Stankevich et al., 2005, Pekka, 2002):

Advantages:

- Potential reduction in costs. This is often difficult to clarify as there is seldom retention of the same service levels before/after a PBC. Also the initial investment necessary to get a network up to standard is often significant and not understood against the long term cost savings delivered by the investment. Many of the reviewed projects (refer Appendix C) noted objectives of either reducing the life cycle costs or increasing the value-for-money, although the data were not present to confirm either finding.

- Improved level of service (could cost more). DBMOT style contracts in particular are implemented for the requirement to raise the standard above that currently in existence. The reviewed projects (Appendix C) noted comments such as "enhancing road safety" and improved social outcomes by better access to markets.

- The transfer of risk to the contractor thereby providing surety of costs to the agency (albeit at a higher contract price). In particular a number of the projects reviewed (Appendix C) noted that a key contract objective was to avoid (or reduce) cost overruns and change orders.

- Securing of an appropriate level of multi-year financing. While an advantage for the road network within the PBC area, the contractual allocation of sufficient multi-year funds to one part of the network may result in a reduction (of typically already scarce) funding for the remainder of the network. Argentina (via the CREMA contracts), Liberia and Zambia all noted that securing an appropriate level of long-term funding was a primary objective of the PBCs implemented.

- More innovation as a result of the PBC contractor having a financial incentive to apply new tools and techniques to the management of the road network. It is noted that the agency effectively gains any anticipated savings from such innovation at the time of bidding, and that it is the PBC contractor who carries the risk of not realizing the benefits during the contract period. This is more noted in the PBCs applied to the developed world (such as the Auckland Motorway Alliance) wherein the underlying quality standards are reasonably assured and the PBC is a means of incentivizing innovation.

- More integrated services (dependent upon the scope of the services within the PBC)

- Enhanced asset management on the part of both the PBC contractor (benefits from understanding whole-of-contract costs and levels of service) and for the road agency (the preparation of a PBC requires fundamental AM skills to be applied). Many of the reviewed projects (Appendix C) noted an improvement in the application of asset management as a result of the PBC, supporting the notion that PBCs are a good way to progress asset management within a country.

- Ability to reap the benefits of partnering, with the skill set of the road agency supplemented by that of the private sector.

- Building a new industry and/or adding new skills to the existing contracting industry with regard to understanding AM. For example the Main Roads Western Australia Integrated Service Agreements model explicitly noted the building of capability and capacity within the client and local industry as being a key objective (Appendix C).

- Achieving economies of scale, thereby enabling the use of more efficient and effective means of delivering the required contractual outcomes.

- Consciously focusing resource (through contractual means with stated objectives) on the long term needs of the asset.

- Quicker to get works implemented, as with the DBMOT model, only the conceptual design needs to be completed, not the full design with all the associated approvals required for a traditional contract model.

- A reduction (or elimination) in the level of corruption as a result of there being far fewer financial transactions (easier to audit) and with the focus on delivering level of service outcomes rather than specific projects, political intervention is also greatly reduced. For example in Tanzania (Appendix C) it was noted that the PBC model was harder to corrupt as there is both a greatly reduced number of transactions, and the community was made aware of contractual requirements and therefore were vocal in ensuring compliance.

<u>Disadvantages:</u>

- A more costly procurement process for the bidders. The costs to industry are much higher than standard procurement as a result of the need to better understand the risks and skill sets being offered.

Also as the PBC implementation is often a new concept, it is necessary to incorporate a significant quality aspect to the selection of the contractor – via either a price-quality trade-off, or via a short listing of contractors before receiving full bid submissions.

- The complexity of the bids also increases the evaluation time required by the road agency, which to ensure a focus on the quality (non-price attributes) should include for the use of a two-envelope assessment method. As opposed to a "lowest price conforming" method of evaluation, where potentially only a single bid needs to be evaluated, under the two-envelope system all bids need to be evaluated.

- A longer procurement process from the time the RFP is let to when the contract is awarded as a result of the bidder needing to visit the site and fully price and analyze all works and risks etc. The overall timeline for the procurement of the PBC may also be long as a result of needing to convince the client that PBC is a good idea, through to convincing the Bank procurement process and engineers that the modifications to the standard OPRC sample bidding documents are appropriate. There is also the risk that the process may be curtailed (or severely delayed) owing to institutional or industry resistance to change.

- The increased cost of having good data (including accurate inventory and historical condition and achievement data) on the asset to be able the contractor to bid accurately and be aware of the risks. While this should happen with/without the PBC (i.e. this is really a cost of establishing and maintaining good asset management and should occur irrespective of the drive for PBC), the PBC often forces a higher level of investment in the data sets. If not done well, data issues can lead to poor outcomes / disputes when the actual extent of the asset or the actual condition is better understood (often after the contract has started).A reduction in competition. Where there is insufficient non-PBC work for a competitor to remain in the marketplace this can be an issue.

- Uncertainty associated with long-term contracting relationships, especially where the term of the contract exceeds the term of any loan or external funding arrangements.

- A potential loss of agency control and flexibility; for example, to reallocate funds during times of fiscal constraint when the bulk of the expenditure is under fixed long-term contractual commitments. In both the developing and the developed world, the road sector is

often seen as having a greater level of flexibility with budgets to both reduce expenditure without the immediate impact that a similar cut in health or education may have, and similarly to provide a stimulus via employment when additional funds can be leveraged. This reiterates the need for the Ministry of Finance to be committed to the PBC initiative, as well as the road agency

- Where the risks associated with the development of the works program has been transferred to the contractor, the agency may lose control of asset management decisions and be less able to respond to political requests for works to be completed in certain areas.

3.3.4 VALUE FOR MONEY

One of the more difficult value propositions to determine is whether PBC are worth doing – i.e. will the benefits exceed the cost aspects on these contracts? While many of the projects reviewed (Appendix C) noted that improving value-for-money was a key objective, the reality is that data were not collected in such a way as to determine if that was the case.

With the implementation of long term contracts what "usually" happens under the old regime often gets specified as what "must" happen all the time under the PBC. Consequently there is often a cost premium for this increased marginal improvement in service levels.

As indicated in the literature and from the project review summaries in Appendix C, some PBC contracts are undertaken because any other contract format would simply be unfeasible, or the current approach is simply not working (more often an issue of construction quality or securing funding). In both the developed and developing nations, the value for money concept of the long term change in the level of service as a function of the long term change in the life cycle costs as proposed by Hyman (2009) are attained – however for developing nations this cost based value is often overshadowed by the significant (and immediate) social (intangible) benefits that vastly exceed the cost aspects.

With Hyman's (2009) approach, it is necessary to consider the "Change in Cost" to be the long term change in life cycle costs, and similarly the "Change in Level of Service" to be the long term sustainable change. In the same way that the cost needs to encapsulate the total cost change of the PBC (including any independent monitoring roles), the level of service should include the wider benefits to the Road Authority that may be gained from the implementation of the PBC on only a portion of the total network.

Where developing countries often consider gains from PBCs to either improve cost efficiencies or improve Level of Service, for some developing countries, PBC may be

the determining factors whether a road network is accessible or not. For example, socio-economic benefits gained through PBC in Africa and South-America vastly overshadows the costs aspects. In these countries, one of the key benefits of a PBC is that it enables for the maintenance of a road network through a contractual arrangement that provides long-term availability of funding, plus less management and administrative onus on the road agency responsible for the network (See case studies in Zambia and Brazil).

Within Tanzania (Ako, 2011) the following was noted:

> *"Being five year contracts the PMMR approach provides a stable and guaranteed cash flow for the Contractors. The contracts give more incentives for a Contractor to be efficient in his work to maximize his income and profits – and in this way the PMMR supports development of the contracting industry.*
>
> *The Regional and District Authorities in the PMMR areas have all displayed their satisfaction with the continuous good condition of the roads, enabling improved administration, regular passenger transport and better access to public services as well as to markets. The significant reductions in transport and travel time are regarded as having major socio-economic impact."*

Pekka Pakkala (2002) identified savings of 20% to be made from the application of an outcome based contract, over and above the 20% savings from simply outsourcing of maintenance. Assuming the notional constant retention of the "value" side of the equation, such findings indicate that the procurement of a PBC would deliver 20% greater VfM than a non-PBC contract.

3.3.5 PBC START-UP FAILURES

Literature has quoted very few PBC projects that have gone through to completion and have retrospectively being labeled a failure or less successful. Especially in the developing countries, "failing PBCs" are normally those contracts that did not get off the ground at all. Most problems associated with the PBC contract normally arises from relationship issues (borne out of misunderstandings of scope, intent, objectives or extent of risk transfer owing to a poor understanding of the issues by the agency and/or the consultant engaged to support the agency and reiterates the need to get sufficiently experienced advice) or from institutional issues that result in a contract not proceeding as intended. The one notable exception is that where price dominates the evaluation procedures, it is possible that the "successful" contractor will find the contract to be financially unsustainable. Under such a scenario there is seldom a chance of the PBC delivering the full benefits anticipated, although the PBC itself may still run to the end of the contract period.

It is often the case in a developing country that a new contractual format may face reluctance from all levels of agencies including (Greenwood et al, 2005; World Bank, 2010 and Hartmann and Dewulf, 2009):

- Lower level staff may perceive PBC contracts as a risk to their jobs, especially where maintenance work or supervision of maintenance is undertaken in-house;

- Managerial staff from agencies may be hesitant to move towards PBCs fearing its potential failure or unpopularity within the agency. This may be exacerbated if there is a loss of control of asset management decisions as a result of inappropriately transferred risk to the contractor; and,

- At governance level there may be stumbling block due to the resistance to change legislation or processes to allow for a PBC framework, including the locking in of budgets for the long term.

It has been observed in all cases where the above mentioned factors were present that the PBC process was considerably delayed to a point where it was cancelled.

That being said, the process of preparing for a PBC requires the agency to develop a detailed asset management plan and become much more aware of the asset management issues such that whether or not the final PBC contract occurs, there are many benefits gained. These extend from consideration of risk profiles, understanding whole-of-life costing and levels of service, through to recognizing the impact of significant overloading on pavements. Any data collection completed can help with a better understanding of the true extent of the asset, its changing condition over time, changing loading (traffic data) and for future benchmarking of performance.

It is therefore worthy to consider if the ultimate goal of attempting a PBC implementation is to undertake the PBC, or if it is in fact to raise the capability of asset management within the client and industry. By better positioning PBC as a facilitator of good asset management, it may be that more agencies would be encouraged to consider an implementation.

3.3.6 A SUCCESS MONITORING FRAMEWORK

The multi-dimensional aspect of PBC success factors were recognized by Piñero (2003) during his development of an assessment framework to measure success of PBC (refer to Figure 6).

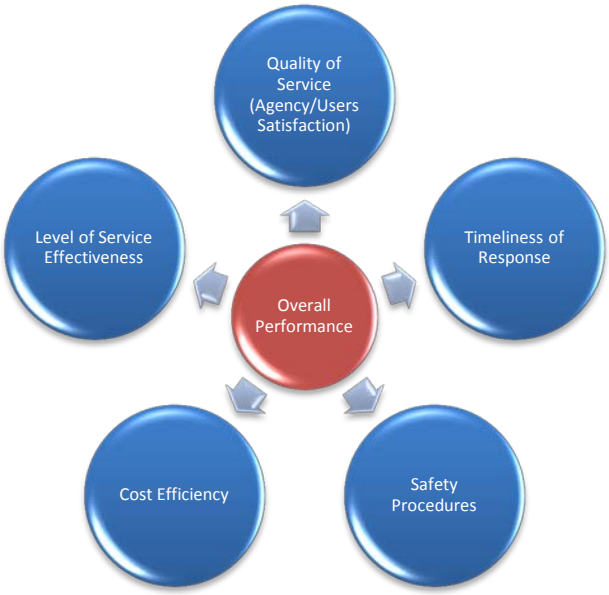


FIGURE 6: KEY COMPONENTS TO MONITOR PBC SUCCESS (PIÑERO, 2003)

In his research Piñero (2003) has developed a method of assessing each of these categories. Figure 7 shows a typical example of outputs from his assessment on bridge condition data that was benchmarked against VDOT requirements. It is recognized that this is a detailed process for assessing a PBC, however, considerations should be given to adopt a simpler process that can be utilized by the Bank to assess PBC, where PBC benefits/value are not that apparent.

2002 REPORT CARD *for VMS and VDOT Maintenance Performance*

Virginia Tech

Sites	Sections of Interstate	Bridge Component									
		Deck		Superstructure		Substructure		Slope Protection		All Components	
		2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
BRIDGES MAINTAINED BY VMS	I-95 (Section 1)	A	A	A	A	A	A	B	B	A	B
	I-81 (Section 2)	B	C	A	C	A	B	A	C	B	C
	I-77 (Section 3)	A	B	B	C	A	A	A	A	A	B
	I-381 (Section 4)										
	All VMS Sections	A	B	A	B	A	A	A	B	A	B
BRIDGES MAINTAINED BY VDOT	I-95 (Section 5)	C	C	C	F	B	B	B	C	C	C
	I-81 (Section 10,12)	B	C	B	F	B	B	A	A	B	C
	I-66 (Section 6)	B	C	B	C	C	F	B	B	C	F
	I-64 (Section 7,8,9)	A	B	A	A	B	B	B	B	A	A
	I-581 (Section 11)	B	B	A	F	A	B	A	NA	B	B
	All VDOT Sections	B	B	A	A	B	B	B	B	B	B

Grade	Condition
A	Actual Rating ≥ VDOT Requirement
B	95% VDOT Req ≤ Actual Rating < VDOT Reg
C	90% VDOT Req ≤ Actual Rating < 95% VDOT Reg
F	Actual rating < 90% VDOT Requirement

FIGURE 7: TYPICAL EXAMPLE OF ASSESSMENT OUTPUTS FOR PBC (PIÑERO, 2003)

What is important in any monitoring process is to recognize that the benefits and costs are those that exist for both the short and long term. As previously stated, where a backlog of work exists (such as the DBMOT model), there is a potential need to invest heavily in the early years in order to deliver the long term lowest life cycle costs. Chi Haw et al, (2011) presented a projected cash flow for a road network to yield the lowest life cycle costs. As illustrated in Figure 8 the investment in the early years may be twice the long term average spend. If the focus of the value for money equation only focused on the first 5 years (which may be the total contract period) then the PBC would be seen as very costly – however recognizing the long term decreased cost of ownership would possibly make this an economically sound investment.

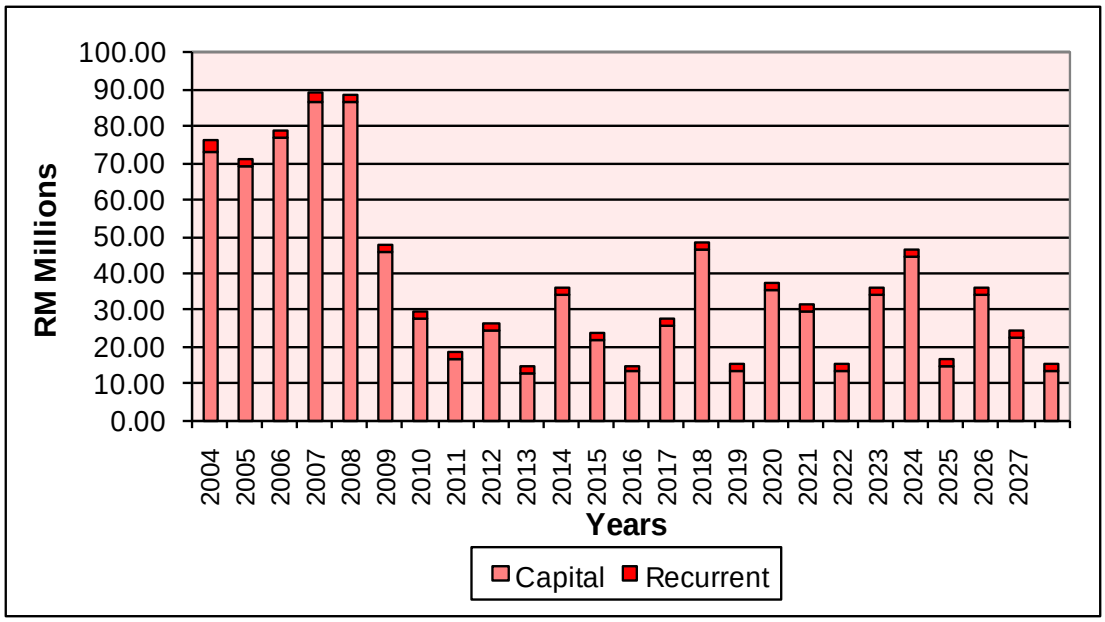


FIGURE 8: FRONT LOADED WORKS PROGRAM TO DELIVER LOWEST WHOLE-OF-LIFE COSTS (CHI HAW ET AL, 2011)

3.3.7 LINKING AGENCY OBJECTIVES TO THE PBC CONTRACT

Despites its importance, especially considering the long-term implications, linking agency objectives in the PBC contract is seldom realized. Too often standard procurement documents are meticulously followed without considering the required changes that would incentivize the desired outcome from the contract to achieve wider agency objectives (Kadar et al, 2007). Some examples where objectives need to be reflected in the PBC contractual documentation are:

Desired road condition needs to be reflected in the key performance measures and reflect overall road agency (road user) objectives and requirements. While the actual condition may vary within the PBC contract area (often as a result of adequate funding) the actual desired condition of the road network should be consistent for a given road hierarchy across the road agency's network. To develop this for the pavements, a thorough understanding of the current condition is required and secondly appropriate statistical tool/parameters need to be used to specify the desired future condition of the network (durability and hand-back measures). What is considered a "poor" road in one network may be deemed quite acceptable in another;

What governance structure needs to be put into place to manage the contract long-term and how does that relate to the existing skills within the road agency or the consulting industry. The role, responsibility and delegated powers of any management board needs to be clearly defined and agree by all parties – can they alter the contractual requirements, or are they just a mediatory group to address conflicts that may arise? Who has input to the setting/adjusting the performance measures over time as more is learnt about the asset and to drive continuous improvement? If an independent consultant is engaged to manage the PBC on behalf of the agency, then the authority they should be delegated will reflect the capability of the consulting industry;

Prevent/control asset consumption to occur during the term of the contract – specify the hand-over condition but also clearly state the desires from the agency at hand-over stage (e.g., establishing a minimum remaining service life). Contractors are willing to comply to the wishes of an agency, if they know before tending exactly what the requirements are; and,

Appropriate contract pricing in relation to provision for risk – clearly define exactly which risks (and the risk boundary[6]) have to be carried by the contractor. Through this the contractor will not only have an increased confidence that the agency is aware of the risk exposure on the network, but they will also be able to price only

[6] The risk boundary is the limit of the risk that is ascribed to each party. For instance with traffic growth, it may be that the risk boundary that the PBC contractor has to cover is for the first 10%, with the consequence of any growth beyond that carried by the client.

the risk they are supposed to. The agency should also be aware that a contractor builds additional risk provisions into their contract price for any uncertainties associated with the contract. Both the term of the contract and size of the network can have mitigating impacts on the risk pricing, with some risks becoming "certainties" with increase in term and size. A good quality data set is essential to partially mitigate this risk.

3.3.8 INSTITUTIONAL ISSUES

Although it is difficult to prioritize the importance of success factors for PBCs, it is well accepted that institutional issues are the foundation of any successful PBC process. This statement can even be taken as far as saying that PBC can only be successful if it is "driven from the top". Furthermore, the organizations 'culture" must be aligned with the desired outcomes e.g. asset management, collaborative long-term relationships etc.

Only having top-level commitment may not be enough. The PBC contracting format has its origins from institutional or road sector reforms. If the status quo in undertaking road maintenance was satisfactory, there would have not been a need to adopt an alternative contracting format. Smith and Grinker (2004) include PBC on the continuum of public service improvements (refer to Figure 9). Their main point is also that PBC in itself is not sufficient to drive improvement in service delivery, but it should also be supported through improvements in performance measurement and management, and in some cases institutional restructuring. There is also a clear alignment between the benefits/enablers of PBC and those of asset management.

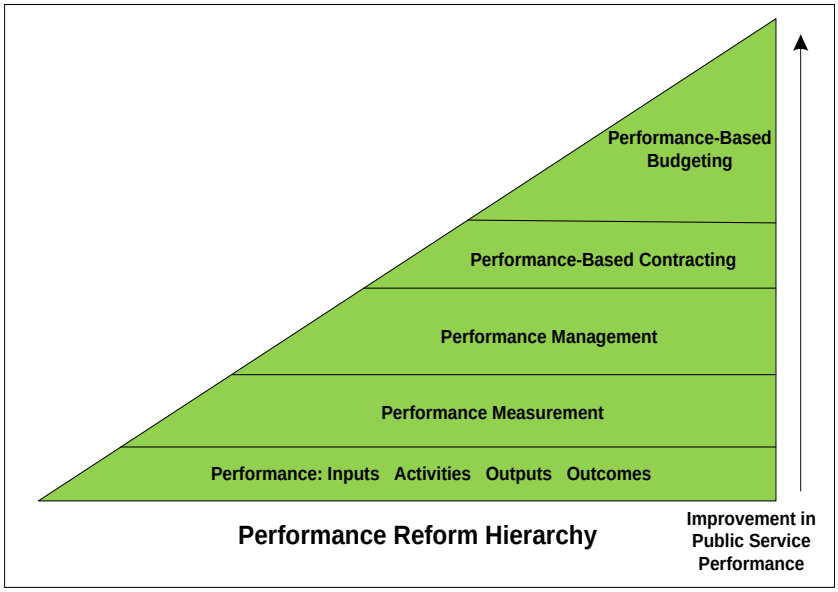


FIGURE 9: IMPROVING PERFORMANCE - INSTITUTIONAL REFORM

(SMITH AND GRINKER, 2004)

The points made by Smith and Grinker (2004) thus implicate a vital issue from an institutional perspective – that is the condition of having a strong desire from the agency to change practices in maintaining roads. For example, sometimes adopting PBC may require high level changes such as some alterations to legislations and bidding or contracting policies. These changes take time and energy and can only be driven by top management.

There should also be mechanisms to address or counter fears and insecurities from staff within the agency. For example, if by adopting PBC, a natural consequence may include some significant job losses (or often a transfer of staff from the agency to the PBC contractor) there will be a strong resistance from within the agency that may jeopardize the process of moving towards PBCs.

Flintsch and Medina (2007) have proposed an algorithm to determine the appropriateness of adopting PBCs with micro and small enterprises (refer to Figure 10). Although this algorithm is very specific for its intended application, it does offer a good framework for a more generic "checklist" for PBC:

a. To test the appropriateness of adopting a PBC within the context of an agency's capabilities and situation;
b. To suggest appropriate steps to address specific barriers within and agency or country to ensure a smooth implementation of PBCs.

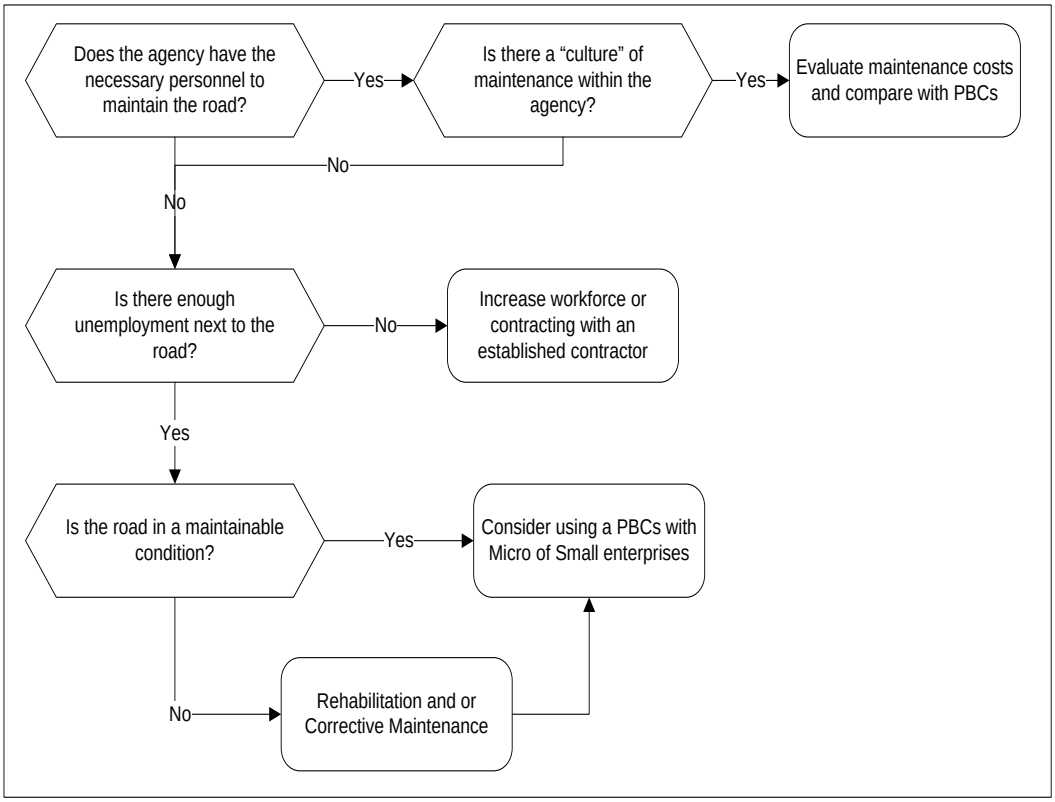


FIGURE 10: FLOW CHART FOR DECIDING WHETHER OR NOT TO USE PBC WITH MICRO OR SMALL ENTERPRISES (FLITSCH AND MEDINA, 2007)

Bennett (2007) examined the capacity of government, contractor and consultant to support a PBC contract. This built on the work of Opus (2006) who developed a similar framework for the Indonesian project. What Figure 11 illustrates is the need for a broad range of capabilities across both the government and private sector if the PBC is to be successfully implemented. Furthermore, the figure illustrates that often there is inexperience on both sides of the contractual divide that impair the ability to put a PBC in place.

Area	China			Egypt			Indonesia		
	Government	Contractor	Consultant	Government	Contractor	Consultant	Government	Contractor	Consultant
Staff Resources	~	~	●	●	~	~	●	●	●
Physical Resources	~	~	●	●	●	~	✖	●	✖
Maintenance Management	●	~	~	~	✖	✖	●	~	~
Maintenance Activities	●	~	✖	●	~	✖	●	●	●
Quality Assurance	●	~	~	●	~	~	~	●	●
Pavement Performance Understanding	●	~	~	~	~	~	●	●	●
Project Management	●	●	●	●	●	●	●	●	●
PMS Experience	●	✖	~	~	✖	✖	●	~	●
Data Collection and Analysis	●	~	~	●	✖	✖	●	~	●
Tender document Development	●	✖	●	●	✖	~	●	✖	●
Partnering Experience	✖	✖	✖	~	~	~	✖	●	●
Business Risk Processes	✖	✖	✖	~	~	~	✖	●	●
Legislative Capacity	✖	N/A	N/A	●	N/A	N/A	●	N/A	N/A

● Moderate-Sufficient capability
~ Limited capability
✖ No capability

FIGURE 11: ASSESSMENT FRAMEWORK FOR GOVERNMENT AND INDUSTRY CAPACITY FOR PBC (BENNETT, 2007)

Lessons Learnt from Brazil

Note: The following has been extracted or distilled from Lancelot (2010).

The introduction in Brazil of performance based contracts for road maintenance and rehabilitation has been relatively successful and initial results in contract execution indicate that such contracts indeed allowed for substantial efficiency gains. Besides, based on early results from the execution of CREMA contracts under Bank projects in the State of Rio Grande do Sul and at the federal level, the use of such contracts has been gradually spreading, with: (a) the federal government having decided to expand the use of CREMA contracts; and (b) a number of states adopting (often with Bank support) such an instrument, adapting it to local circumstances (see box below).

Box 1. Status of performance based contracts on various road networks in Brazil

. Federal government: 25 percent of the network already managed by performance and decision taken to expand CREMA contracts further on the federal paved road network by 2010
. State of Goias: performance-based maintenance program underway on the entire state road network (see Annex 8)
. State of Minas Gerais: CREMA program underway on 30 percent of the state paved road network, to be expanded to 65 percent of the network by 2010 (see Annex 9)
. State of Bahia: contracting underway for first 8 CREMA contracts
. State of Tocantins: technical specifications for CREMA type contracts being drafted

This positive assessment should not mask the fact that performance based contracts are still a new instrument in Brazil, which, to reach its true potential, already required and will continue requiring improvements and adaptations to match ever evolving needs, demands, and constraints, independently from the necessary improvements in the overall public sector management capacity, including that of executing agencies. Indeed, the execution of the first performance based contracts revealed a series of flaws in the design of the contract and related processes. The main lessons learnt to date are presented below.

On strategic orientation:

- *Particular adaptations of the performance based model to local specificities are a fundamental process to ensure adoption of the model and full ownership.*

- *A contractual instrument should not be considered as a silver bullet to try to resolve a whole host of contract management issues including:*
  1) *Efforts to improve payments predictability*
  2) *Efforts to increase timeliness and quality of engineering designs*
  3) *Efforts to decrease price addenda*

- *Increasing contractors' accountability on the performance has been achieved on maintenance services but remains limited on rehabilitation works. In follow-up performance based contracts, a number of adjustments have been made: (a) bidding takes place on the basis of detailed engineering design based on a strengthened typology of rehabilitation interventions that is now detailed by the administration, (b) rehabilitation works (which may comprise 80—90 percent of the contract price) are now detailed in "globalized" price per solution of rehabilitation, and (c) increased flexibility in road management is given to contractors, notably on the timing of interventions:*

  1) *Recent performance based contracts are tendered on quality detailed engineering designs (though standardized and simplified) on the basis of strengthened technical solutions.*
  2) *Likewise, globalized prices per solution of rehabilitation were adopted on recent performance based contracts to increase flexibility in the contract management*

3) *The contractors are free to adapt the chronogram of interventions up to the limit of 3 years for the completion of the rehabilitation works (against 4 years in the first CREMA contracts). This limit is further expected to contribute to increasing contractors' commitment to quality works.*

- *Increasing private sector accountability and focusing on results do not mean reducing the administration commitment*

B. On operational options

- *Simplified designs have proven to be key in improving efficiency of contract management and execution.*
    - *Designs for performance based contracts have been based on solutions deriving from an approved catalogue of standard technical solutions and standardized (as well as simplified) presentation of designs. Relatively to traditional engineering designs, simplified designs, which are cheaper, are well adapted to design simple civil works such as road rehabilitation. The rationalization gained through clear guidelines on "how to" (typology of field data, methodology of investigations and modalities of presentation) and "what to" (proposed solutions guided by the catalogue) helped both (a) the designers in producing quality design and (b) the administration, easing the process of project revision.*

- *The monitoring system needs to be rational and of easy use to be credible*

- *The sanctioning system for non-compliance with performance indicators needs to be workable.*
    - *The introduction of financial penalties for non-compliance with specified indicators was a complete novelty in civil works contracts, and an attempt to make contractors more accountable for the services they provide. Penalties were introduced initially as fines, which was a mechanism too unfamiliar both for the public and the private sectors (very few notifications were ever made and payments of fines have been even rarer). Penalties are now made through payment retention from the monthly installments to be made to the contractors.*

- *CREMA contracts should exclusively focus on road rehabilitation and maintenance*
    - *In its actual form, CREMA program's overall efficiency relies on the simplicity of the activities executed under the contracts, focus on simple road rehabilitation works and maintenance services, and streamlining of their preparation, execution, monitoring and managing. As such, it is not an adequate instrument to undertake complex civil works (for example, bridge widening) or overly specialized services (for example, weighing platforms for heavy vehicles or road condition surveys).*
- *Longer implementation periods increase contract performance's resilience to budgetary constraints.*

- *While traditional rehabilitation and maintenance contracts have an average implementation period of 18 to 24 months and a precisely defined work program, CREMA contracts have an implementation period of 60 months and a built-in flexibility to allow the contractors and the employers to revise, within limits, the timing of rehabilitation works implementation, to better adapt to variations in budget availability.*

Lessons Learnt From Argentina

[Note: The following is extracted/distilled from Silva and Liautaud (2011)]

Valuable conclusions and general lessons can be derived from the past fifteen year experience:

- *The promotion and expansion of a long-term performance-based system such as the CREMA is achievable when: (1) the political will at the highest level exists, (2) the local highway construction industry is strong and responsive to innovation, and (3) the implementing agency is committed to outsourcing the management of its assets to the private sector, has a long standing tradition of conducting reliable annual surveys of road condition, and is endowed with qualified staff to carry out technical and economic analysis of subprojects, while capacity for procurement and conducting environmental assessment is strong.*
- *With the adoption of CREMA as an asset management modality, DNV's work-force has been reduced at an average rate of about 4 percent per year, (from about 3,700 in 1994 to about 2,100 in 2010) while maintenance by force-account has also been reduced from over 50 percent to about 30 percent (including unpaved roads). DNV's role currently focuses on strategic planning and management of national budgets and the related contracts, and no longer on execution of works.*
- *In practice, CREMA contracts can become a useful mechanism to ensure some minimum level of road maintenance funding. Experience during implementation shows that even at time of fiscal constraints, the budget process honored the CREMA contract as a long-term commitment, and funds were allocated to them in priority.*
- *Using formal planning tools such as the HDM – or other holistic life-cycle system - for cost analysis, including user's costs, and for determining optimum design thickness of overlays and budget allocations for road maintenance and renewal, is instrumental for the successful implementation of CREMA.*
- *The CREMA contract, with its mix of capital intensive, high value rehabilitation works, and labor intensive low cost routine maintenance, encourages large contractors to subcontract the latter work and helps promote a healthy development of small local contractors, while the main Contractor retains the overall responsibility for the whole contract.*
- *In an environment where the CREMA system is being tested for the first time, Bank's financing, at a high cost-sharing, is likely to provide strong assurances that funds will be available for payments and could be instrumental in getting contractors to bid for the works. Once the system is well entrenched in the*

country's culture, Bank's financing becomes less relevant (locally-financed CREMAs in Argentina over the last 5 years have also enjoyed a good response from Contractors).

- *The magnitude of rehabilitation works is not considered to be a factor for deciding to use or not a performance-based contract. In Argentina, the system has proved successful when no rehabilitation works are included in the contract (for ex. on the former km-month contracts) or when the rehabilitation works are significant. The length of the contract could be adjusted depending on the degree of the rehabilitation works and the life-cycle of such interventions.*
- *When overlay design thickness is close to the optimum and when the entire contract length is to be renewed or rehabilitated, a five years contract period is probably too short and consideration should be given to extend the contract duration to between 7 and 8 years, thus engaging the Contractor's responsibility for maintenance for over a period of 5 to 6 years after rehabilitation.*

Other relevant lessons are related to contract management decisions during the project cycle under the control of the road agency that if not properly addressed, could jeopardize the overall cost-efficiency of the system. In particular:

- ***Design stage:*** *(i) the need to ensure that preliminary designs are commensurate to surface and traffic characteristics of the network, avoiding unnecessarily high rehabilitation standards that could deviate from the optimum strategy that provides the maximum rate of return. Each additional cm of asphalt concrete overlay in the network costs around US$20,000/km, representing US$3 million in a typical 150 km-long Malla; (ii) the need to adequately establish the routine maintenance activities required over the entire network, considering the extent of the rehabilitation works carried out, to avoid excessive increases in the costs of this activity. Unreasonable quantities assumed for activities such as pothole patching and crack sealing that will not occur on a recently rehabilitated pavement and will not be carried out by the Contractor, while paid to him on a lump-sum basis, will have an important impact in the cost-efficiency of the contract. The patching component for instance can represent between 5 and 50 percent of the total cost of the routine maintenance and could add up to US$2 million for a particular contract.*
- ***Procurement stage:*** *The importance of building the required capacity to understand the market in which the road sector operate to better design projects, plan activities and enhance competition, transparency and cost-efficiency in the procurement of works.*
- ***Implementation stage:*** *(i) The importance of enforcing the contract agreement and in particular, applying the agreed penalties when non-compliances with the terms of the contracts are detected; (ii) the need to refrain from approving variation orders during contract execution that are essentially intended to enhance and/or correct the originally specified design, as opposed to being the result of unforeseeable or exceptional events as is normally allowed under the terms of the CREMA lump-sum contract.*

3.3.9 RELATIONSHIP ISSUES

PBCs are often classified by authors as Relationship Based Long-term contracts. This effectively illustrates the importance of relationship aspects in ensuring the success of PBCs. Marmion (2007) stated:

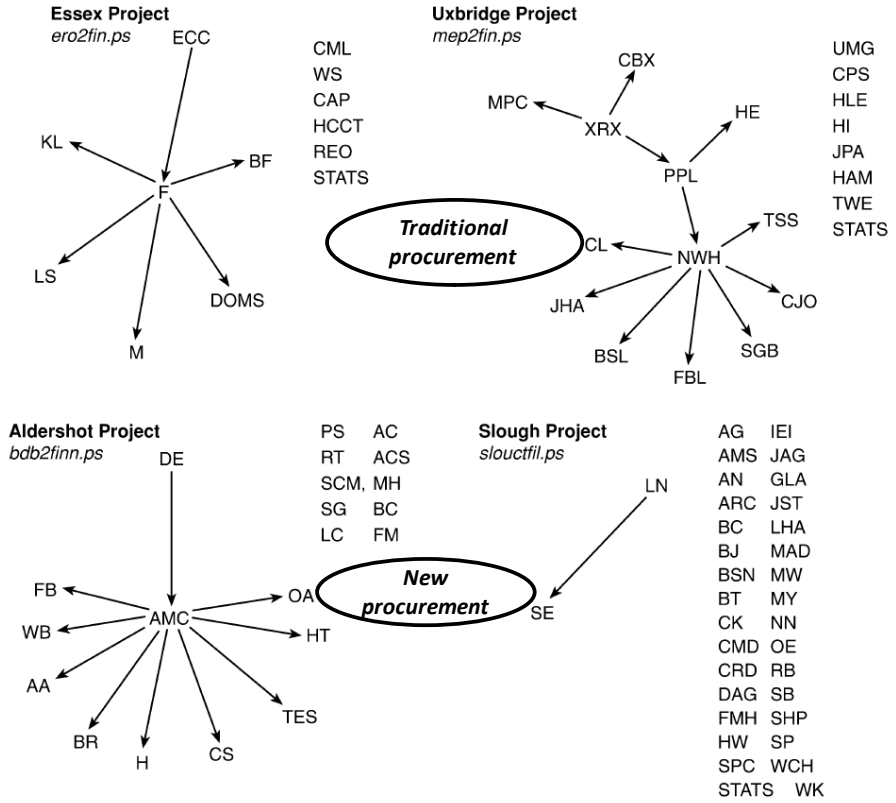
> "*In a long term contract environment, a strong and enduring relationship between asset owner and contractor is paramount*"

As illustrated within Figure 12, the responsibilities change dramatically across the range of contract models. Associated with these changes in responsibilities, comes a change in the nature of the relationship itself – with the contractor moving from a subservient provider of resources at the left of the figure, through to a master of his/her destiny on the right.

RESPONSIBILITY MATRIX FOR CONVENTIONAL PROCUREMENT AND PPP OPTIONS							
			Public-Private Partnership				
Category	**Works and Service Contracts (conventional procurement)**		**Management and Maintenance Contracts**		**Operation and Maintenance Concessions**	**Build Operate Transfer Concessions**	**Privatization**
Type	Design, Bid, Build	Design and Build	Management Contracts	Performance-Based Contracts	Lease or Franchise or Affermage *Brownfield*	BOT/DBFO/ BOO *Greenfield*	
Design	Private by fee contract	Private by fee contract				Private by concession contract	Private
Build	Private by fee contract						
Operation and Maintenance	Public	Public	Private by fee contract	Private by BBC contract	Private by concession contract		
Finance	Public	Public	Public	Public			
Own	Public	Public	Public	Public	Public	Public after contract (BOT/DBFO) or Private (BOO)	
Private sector revenue options					Tolls (concession model)		
				Availability payments (PFI model)			
				Government guarantees and support Other support (eg insurance)			

FIGURE 12: RESPONSIBILITY MATRIX (SOURCE: EGIS VIA PPIAF TOOLKIT)

Literature on this issue mostly covers the socio science aspects of relationship factors within teams towards achieving common goals. From a project management perspective most literature deals with governance structures and only broadly emphasizes the importance of relationships in ensuring successful contractual aspects. For this study, the most important aspect was considered to be the governance structure of PBCs. This is best illustrated in Figure 13. This figure effectively shows that traditional contracts are depending on a number of relationships for given different aspects of network maintenance. Should one of the relationships become redundant or fail, there is some replacement potential in the contractual relationships given other equally weighted relationship that may be working well on the same contract. However, the PBC contractual relationship often relies on only 1 person from the contractor and one person or representative from the client. If this relationship breaks down, the entire contract is at risk.



Note: the Aldershot project sociogram shows the Prime Contractor (AMC) in a position of centrality in relation to all other project actors. Approximately 50% of the project actors are linked into the performance incentive network. Those actors listed to the right of the sociogram are isolates; they are not connected to (and not therefore associated with) the performance incentive network. By contrast, the Slough project sociogram shows two actors only linked in a performance incentive relationship (the developer and its future tenant). All other actors are isolates. This is a partnering arrangement which places reliance upon performance incentives or formal contractual arrangements.

FIGURE 13: COMPARING CONTRACTUAL NETWORKS OF TRADITIONAL VERSUS NEW PROCUREMENT OPTIONS (PRYKE, 2005)

Another well-known but often forgotten concept of PBC contracts is that there is a strong relationship between the degree of "method specification" and the required strength or trust in the relationship. As illustrated in Figure 14, PBCs are often

associated with a low degree of specification and a high degree of dependence on the relationship. Note that PBC contracts have fewer specifications since only the outcome performance measures are specified thus not as dependent on any design, material, method or production specifications that are normally associated with traditional contracts. Therefore, PBC contracts falls in the opposite quadrant to traditional contracts that relies on a higher number of specifications but less so on relationship issues. Consequences of falling into a category of low degree of specifications and weak relationships (bottom left quadrant) are often associated with PBC contracts that failed.

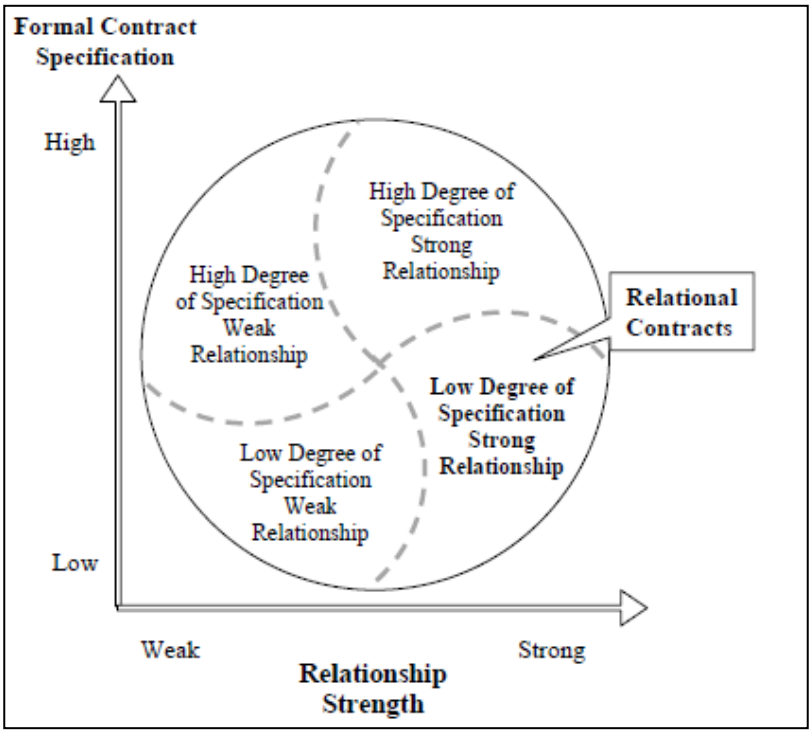


FIGURE 14: DIFFERENT CONFIGURATIONS FOR CONTRACTS (AMIRKHANYAN ET AL., 2010)

A focus of this research needs to look into specific relationship issues that contributed or worked against successful relationships of PBC case studies. Some of these need to cover:

- Contractual governance structures;
- Skill sets within the key relationship representatives;
- Specific contractual allowances to promote relationships and develop a PBC culture.

3.3.10 RISK MANAGEMENT AND PBC

Risk management has traditionally not been a well-known and used concept in the management of road infrastructure (see later paragraphs). Despite of this, it is believed that contractors understand risk better when compared to road agencies and as a consequence are also willing to take on risks in relation to network management as they offer revenue and profit opportunities. As illustrated in Figure 15, the portion of the risk that the agency carries (and conversely the contractor carries) decreases as the contracting model moves from fully in-house through to the long term road concession (DBMOT) type contracts.

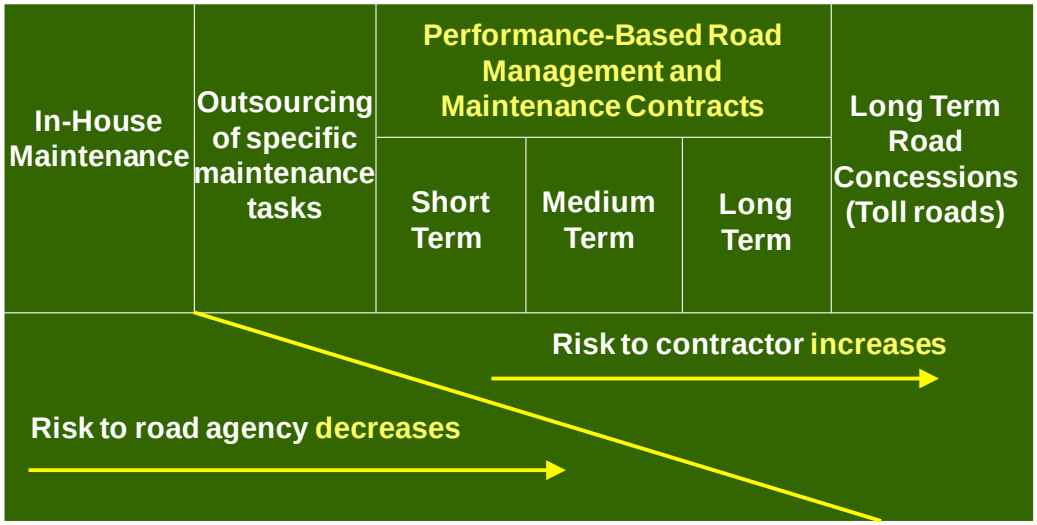


FIGURE 15: RISK SHARING BY CONTRACT MODEL

(OPUS 2006 ADAPTED FROM ZIETLOW, 2004)

As a result of the above, risk sharing aspects should be considered as a tremendous opportunity offered through PBC, if it is applied appropriately and equitably. Spangler (1987) explains the concept of risk appetite according to Figure 16. There are risk that may be categorized "outside of anybody's control" such as natural disasters and then there are risks that are simply unacceptable, such as following unsafe work practices. Likewise, there is also distinction in appropriate types of risk being shared between the contractor and the client body. A general rule in this regard is that the person most likely to manage/avoid a particular risk would also be the appropriate person carrying that particular risk (Porter and Hatcher, 2010).

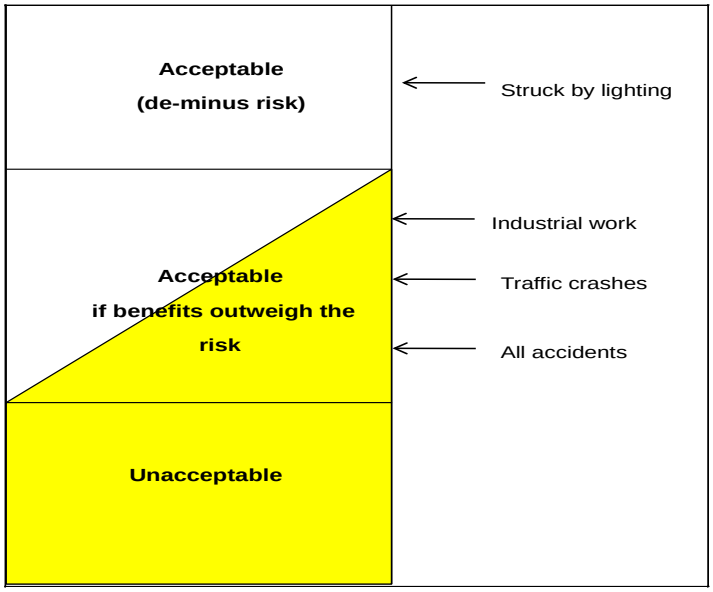


FIGURE 16: RISK APPETITE CATEGORIES (SPANGLER, 1987)

Literature on risk aspects related to PBC was widely available. There were a number of sources that investigated theoretical risk concepts in relation to probability theories applied on achieving specific performance outcomes. For example, Jacopino (2007) investigated the probability of the performance payments exceeding risk of under-achieving the performance specifications. In his application he has used Monte Carlo simulation to quantifying the risk distribution applied on an aerospace maintenance example (See Figure 17). He concluded that the entire risk margin was not under threat by the PBC framework, except for systematic failures which all were under the contractor's control.

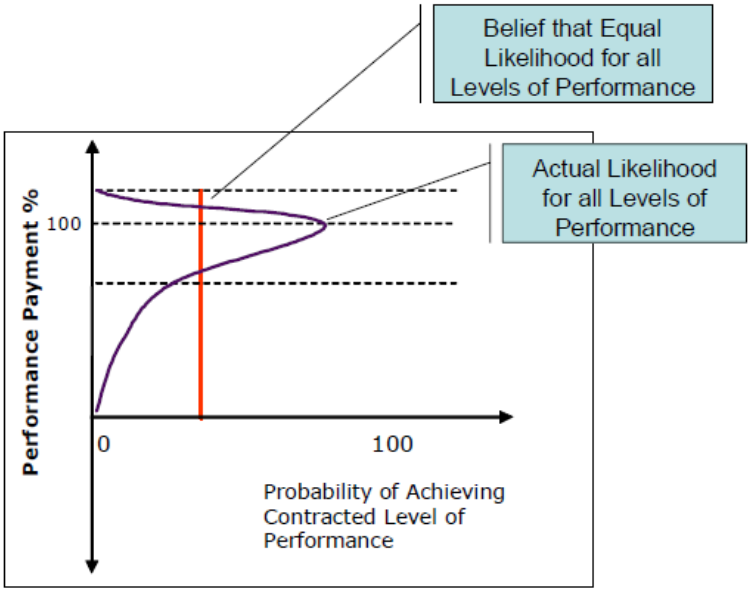


FIGURE 17: LIKELIHOOD OF SUCCESS IN PBC PAYMENTS EXCEEDING RISKS (JACOPINO, 2007)

Damnjanovic and Zhang (2008) developed a generic framework that quantifies performance-based risk in terms of premium cost for different contract specifications, and preventive maintenance/rehabilitation strategies. From this framework the authors have illustrated its application through the presentation of Figure 18. This figure (for the specified road link) demonstrated that the pivot point was at a ratio of failure cost and rehabilitation cost equaling 2.7. Below this value, the contractor could adopt a "wait and see" policy since the risk of failure cost would be lower than the rehabilitation costs. Above this ratio, immediate rehabilitation would be more cost effective. However, as the contractor moves through the contract period, the ratio would increase, meaning it is more likely that the contractor would adopt a "wait and see" policy in later years of the contract period, when the payback period was not so long.

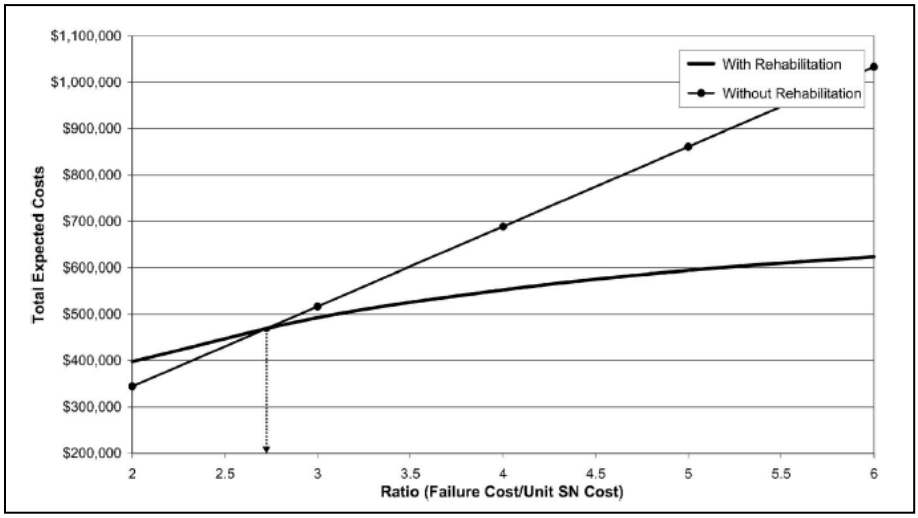


FIGURE 18: EFFECT OF FAILURE COST/UNIT SN COST RATIO ON TOTAL EXPECTED COSTS (DAMNJANOVIC AND ZHANG, 2008)

Although interesting it was felt that most of the available literature have been very theoretical and of little value for the developing countries. Through this project it is believed that a set of pragmatic guidelines would be of more value. It is fair to say that risk management is not a well-defined and used process is the road engineering sector. Other sectors such as the water and sanitation sectors employ risk processes for the management of their network more effectively given the "unseen" nature of this infrastructure. For this reason, Hill et al. (2010) has proposed a risk framework for the management of road networks. In this framework, road network management risks have been classified into four categories illustrated in Figure 19. It is believed that this framework could be used as a basis for developing similar risk categories that should be considered in setting up a PBC for developing countries.

FIGURE 19: RISK CATEGORIES FOR MANAGING ROAD NETWORKS (HILL ET AL 2010)

The literature has also identified a significant educational process in relation to both the client and the prospected contractor's understanding of risk. For example, contractors in Indonesia were highly concerned about potential growth in overloading of the roads. However, based on investigations, overloading was already taking place to levels that would be hard to exceed both in terms of number of vehicles being over loaded and the physical capability of trucks to be more overloaded than current levels i.e. when trucks are overloaded to points where its axles break, further overloading would not be possible. Therefore current practice of designing for these levels of overloading sufficiently covers this risk already. Within the proposal for implementing PBC into Punjab (India), Opus (2009) recommended that risks be allocated according to the profile contained within Table 4 (Appendix E contains the full table).

TABLE 4: SAMPLE OF THE EXAMPLE RISK ALLOCATION TABLE (OPUS, 2009)

Contract Risk Profile			
Risk Description	**Contractor Risk**	**Employer's Risk**	**Risk Boundary**
1) Legislative changes during contract period		Risk excluded	Verified adverse Price, Resource or Time Implications
2) Government of Punjab policy changes		Risk excluded	Verified adverse Price, Resource or Time Implications
3) Changes to Network size, except as provided for in the contract documents		Risk excluded	Verified adverse Price, Resource or Time Implications
4) Maintaining private access-ways and pedestrian facilities located outside the kerb line and/or edge of seal in defined Built-up areas.		Risk excluded	Verified adverse Price, Resource or Time Implications
5) Stockpile and Disposal Sites	Risk included		Intractable Landowner Issues
6) Land Entry Agreements	Risk included		Intractable Landowner Issues
7) Identification and reporting to the Employer of the need for forestry clearances required for Improvement and/or Safety Works	Risk included		Provision of an unencumbered RoW
8) Seeking and obtaining approval for forestry clearances		Risk excluded	Verified adverse Price Resource or Time Implications
9) Land acquisition or other clearances required for Improvement Works		Risk excluded	Verified adverse Price Resource or Time Implications
10) Changes to Contract Performance Measures (MPM's, RUS&CPM's, and RDPM's), see Maintenance Specification		Risk excluded	Verified adverse Price Resource or Time Implications
11) Changes to annual surfacing renewal and pavement rehabilitation quantities, see Maintenance Specification, Section 5	Risk included		Employer instructed changes beyond annual preservation quantities
12) Changes to the Five (5) Year Program	Risk included		Employer instructed changes beyond annual preservation quantities

A very strong pavement from Indonesia (Henning, 2010)

A more typical pavement in Punjab (India)

FIGURE 20: PAVEMENT DESIGN FOR HEAVY TRUCKS

In another example (see case study result), insufficient estimation of risk may occur in cases where the improved road condition encourages a step change in socio-economic developments. In most African PBC traffic growth in excess of 90% were experienced as a result of PBC based road improvements. It is understandable that these growth rates were well outside of the perceived risk profiles for these contracts. This emphasizes the importance of conducting thorough investigations and having flexibility within contracts to deal with this type of situation.

3.3.11 The Relationship between Asset Management and PBC

From an academic perspective, procurement strategies are one of the components that are lumped under asset management processes. The reality is that by its nature one of the primary benefits of PBC is the realization of asset management practice improvements (Porter 2000) and (Barrett et al, 2002). For example, since the implementation of PBC in New Zealand, a significant asset management skill increase has been observed amongst contractors.

In order to develop PBC contractual specification, a thorough knowledge of the network, its performance and desired future service and performance levels need to exist or be developed. This preparation work has strong similarities to recommended best practice defined for Asset Management Processes (NAMS, 2006). Where these practices are not followed, the resulting contract often lacks realistic and or meaningful performance targets.

Prospective contractors bidding for work have to be fully aware of the required asset management skill set for entering into a PBC contract and, where these skills are lacking external assistance must be brought in. The primary goal of the PBC in many cases is therefore the improvement of asset management practices with the PBC itself a simple delivery model for the physical works activities.

There would likely be less resistance to the concept of PBC if the overall process were created to align with the figure below.

Figure 21, illustrates that the first stage of any PBC initiative should be the completion of an asset management plan (details in NAMS, 2006). At the end of this phase, the right combination of Delivery Alternatives could then be rationally discussed, with a full understanding of the expected level of service, risk profile etc. This would then enable for a better (more equitable) comparison of the costs, benefits and dis-benefits of each model to be had.

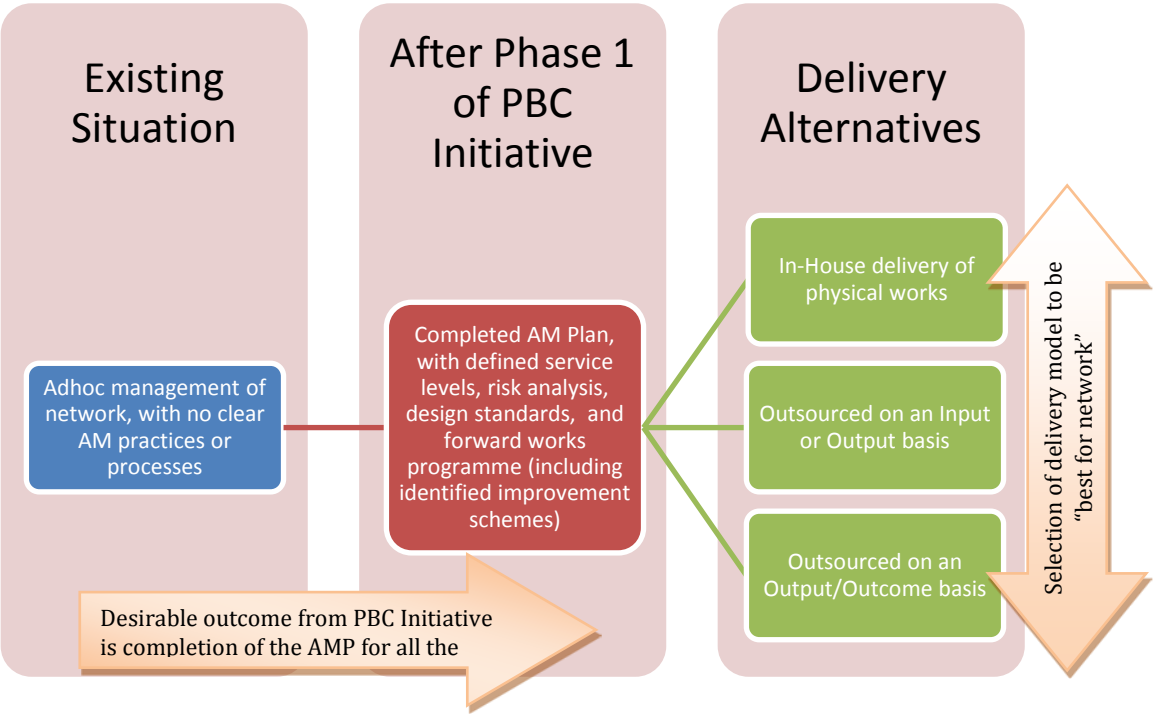


FIGURE 21: SEPARATING DELIVERY MODEL FROM ASSET MANAGEMENT

We note that there is a risk that any forward works program identified by the road agency and/or consultant is likely to significantly influence the PBC contractors thinking in terms of their bid work quantum. Such influence may impact on the encouragement to be innovative in terms of maintenance methods that could potentially alter asset lives.

3.3.12 LIMITING ASSET CONSUMPTION

Road network owners realize that it is possible to maintain certain performance standards such as roughness without necessarily adopting appropriate investment levels for rehabilitation works. For example one can follow a regime of intensive pre-reseal repairs prior to resurfacing instead of rehabilitating sections. Although it may seem that the network is performing well – there may well be a significant decrease in the remaining life of the pavement asset. This is particularly of concern in the latter years of a contract, wherein the period for the contractor to gain from any investment is short.

There are two theoretical ways of controlling the resulting residual life (to limit asset consumption) of a network during a PBC contract. The first method is the measure the actual strength of the roads according to Falling Weight Deflections (FWD), Benkelman Beam measurements or similar. The second method is to specify a minimum level of rehabilitation work that needs to be completed on a network, along with a strong quality control requirement on the materials used and the construction results to be achieved.

The former method (usage of FWD testing) is better aligned to the PBC ethos as it leaves the response at the sole discretion of the contractor. The latter method, albeit counterintuitive for a fully outcome focused PBC as it requires the specification of outputs, is often used to provide an assurance that even if the outcome measure is not driving the right decisions, that the minimum quantities constructed to an acceptable level of quality, will provide a benchmark investment level.

The intent behind such minimum quantity (or underpinned quantities) clauses are to signal to the contractor that the owner believes that there is a minimum quantity of resurfacing and renewal/rehabilitation work necessary to deliver the performance requirements. This is also one way of countering the risk of underpricing of the PBC in situations where the contracting industry is not experienced in the production of forward works programs.

Relying on strength measurements such as the FWD on their own has proven to be unrealistic as these measurements are highly variable in nature. For example, any measure derived from the FWD will be highly influence by the moisture condition during the surveys (Rohde, 1994). As a result of this, expected lives calculated based on the FWD can vary in magnitudes. For example, Arnold, et al., 2009 has demonstrated that expected traffic loading forecasted on the bases of FWD could be out by a factor of up to five. In their words:

> *"When considering using a percentile value of the FWD Austroads M-EP predicted lives, it can be expected that a good prediction will be within a factor of 5 of the actual life. For example if the FWD prediction is one million ESAs then the actual life could be anywhere from 0.2 million ESAs to five million ESAs*."

This range of variability in testing results is likely to make contractual enforcement extremely difficult. A cautionary approach is therefore often recommended, using the combined FWD and underpinned quantities, in association with the use of approved materials and design procedures, and quality control testing.

This is one technical area where more research into the frequency of testing and the method of analysis and interpretation would be of significant benefit. It is also necessary to better understand the differences between the design life, the functional life and the economic life of the pavements. These terms are defined as:

- Design Life: Many (pavement) design methods are based on a risk based approach wherein 95% (or similar) of the assets must last a given design

life. By definition the vast majority of assets will have a functional life well beyond the design life.

- Functional Life: The life over which the asset is physically able to perform its intended function and is often significantly greater than the Design or Economic life
- Economic Life: The period over which an asset is depreciated within the financial accounts of the agency. This is typically the lowest of the three life values.

3.3.13 PREVENTING HAVING TO ACCEPT UNREALISTIC LOWEST PRICE BIDS

There are significant risks in adopting the lowest price conforming bid as a basis for awarding contracts under performance based contracting. Given the relatively long term of PBCs, low prices are typically unsustainable and are often received from contractors who do not have the ability to undertake contracts of a large scale and nature.

Although increased guarantees go some way to addresses this risk, it is still unlikely to be effective go far enough in protecting the client. A stronger approach is by the introduction of a sustainability hurdle. Bids falling below the internally established "sustainability hurdle" are disqualified.

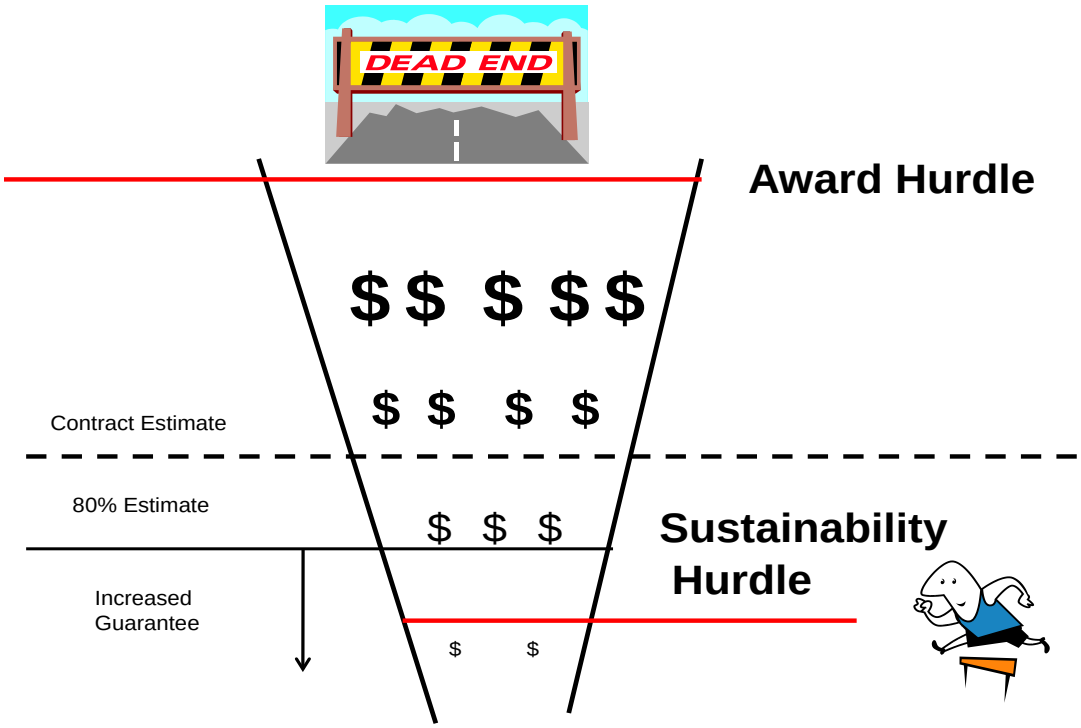


FIGURE 22: ALLOWABLE PRICE RANGES FOR PBC (HENNING AND MILLER, 2010)

3.4 LEARNING FROM INTERVIEWS

Key learnings from the interviews (refer to Appendix C for summary of projects) are:

- Where PBC has had the biggest impact in developing countries to date is via the DBMOT model (refer to Table 5), wherein the initial investment to upgrade a prior poor network has resulted in significant socio-economic benefits to society;
- The main challenges occur in getting the PBC to the point of contract award, with many WB funded projects failing to progress or stalling before that stage is reached;
- The process to implement a PBC can be very long and requires a strong individual to lead the initiative if it is to succeed. In some cases it may be that the slowing down of the project is a deliberate means of precluding the PBC from occurring. A strong mandate and leadership from the top of the organization is required;
- The form of the maintenance specification has a significant impact on the ability to enforce the PBC. The use of "defects/km" rather than "response times" to address most defects not only makes the management of the PBC simpler, but also makes it easier for the public to understand the service levels they can expect. This latter "public understanding" is also a key part of the ability of the PBC to limit corruption, as the public can easily determine if the service levels they have been promised, are being delivered.;
- PBCs (as with other contract models) to be cost competitive require a size of network operation that enables the contractor to deliver works efficiently via a high productive utilization of both labor and plant. Typically this makes small networks (those which cannot make efficient use of resources) unattractive to a full scale OPRC PBC as there is not sufficient work to sustain the workforce and/or will result in significant downtime for what can be quite expensive construction equipment. Smaller networks may still benefit from a DBMOT type contract to yield benefits from improved workmanship[7] even where the MOT aspect is not optimal (i.e. the life cycle benefits from the improved workmanship may well offset the lower efficiency of the maintenance period for a smaller network). An exception to this "bigger is better" rule is the small performance-based road maintenance contracts with cooperative microenterprises used extensively in Latin America, as these microenterprises can undertake tasks that require very little equipment and therefore still yield high utilization for the day-to-day maintenance of unpaved roads and for labor intensive activities on paved roads.;

[7] In such cases the scope of the maintenance activities should be limited to the pavement (or other) works that the DBMOT can address efficiently, and retain the services (in house or external) of the supplier for the other "non-quality" maintenance activities such as litter removal, vegetation control etc.

- The end of contract term residual life measures is important in all contracts no matter the contract period involved. It is possible that the risks associated with residual life decreases where the contract term aligns with the expected functional life of the assets as a result of an expectation of the need for significant renewal works to occur in the period just after the end of contract.;
- The risks of inflation, historic construction quality and traffic loading are common concerns and need careful consideration to ensure the contracting industry does not price from "fear of the unknown";
- PBC contracts limit the opportunities for corruption owing to the combination of a decreased number of transactions occurring, and (when done well) the ability of the public to assess the performance of the contractor via the service levels;
- People are the most important component for success irrespective of the contract model being engaged. It was noted that those projects that were most successful also appeared to have TTLs that were well informed on PBCs and who understood the ethos of asset management. and
- There are concerns about the lack of focused guidance for the implementation of PBCs into different road networks. The time to implementation of PBCs is also compounded by the lack of suitable sample bidding documents that recognize the different situations.

3.5 KEY FINDINGS FROM STOCK TAKE&LITERATURE REVIEW

Based on the stock take and literature review, the following key points are noted:

1. Key Enablers: Aspects including a stable funding stream to encourage the private sector to take on the financial risks of a long term contract, a reasonable data set that provides an adequate understanding of the asset to manage risks, and a strong understanding and commitment within road agency to the PBC objectives with recognition of the benefits, risks and potential pitfalls etc., are all essential to allow proper planning and anticipation of any potential "road blocks" to the process and effectively enable the commencement of the PBC process. Without these in place, the ability to commence a PBC of any sort is severely constrained.
   For instance with the Polish experience, the current significant investment from the European Bank into new infrastructure which places a requirement for Poland to match the loan with a local contribution, results in a severe shortage of funding for the maintenance and renewal of the existing (or newly constructed) infrastructure. While some progress may occur in establishing PBCs at a local level, until there is a focus on maintenance (including funding) it is unlikely that significant progress can be made at a national level.

2. Key Challenges: The OPRC sample bidding document is being used for a wide range of situations it was never originally intended for, resulting in the need to include excessive time to customize it to each situation (in terms of both the specifications and the payment models), with associated increase in approval times through the Bank processes. Different sample documents are required for each generic set of circumstances along with advice for those preparing/using them including[8]:
   - Design Build Maintain Transfer/ Design Build Operate Maintain and Transfer;
   - Network Management / OPRC– review of the existing OPRC sample bidding documents to pick up recent innovations in recent implementations); and
   - Unpaved roads.

   There is also a need to review the procurement rules to ensure the selection of a suitably skilled contracting entity and for strong professional advice in design and asset management. The PBC model is much more complex than a typical construction contract and contains elements of both professional asset management services and road construction/maintenance. It is important that a two envelop quality based selection process is employed. Accordingly it is recommended that there a strong emphasis is placed on the quality of the bidding team and capability and that price alone is not the sole selection criteria.

   Where job protection is seen as a greater importance than delivering a good asset management outcome, then the chances of successfully implementing an OPRC are greatly reduced. Management of the workforce, possibly from the public to the private sector, and being willing to reduce the size of the public sector accordingly, are essential requirements for a successful PBC implementation.

3. Key Success Factors: The following are found to be key factors in determining the level of success with the resultant PBC. Without these the success will be put in doubt, and/or there will be a significant price premium incurred:
   - Strategic Alignment (e.g. between Government, funding body, finance department, road agency, legal framework etc.) is necessary to ensure the private sector have full confidence of being paid and that their investment in bidding for the work is likely to pay dividends,
   - Risk, in terms of the understanding and appropriate sharing of risk, plus the definition of the risk boundary, is an essential item to be understood by all parties. In particularly the private sector is often concerned over the risk of overloading and historic construction quality, and the liability of the private sector for these items needs to be very carefully managed;
   - Asset management has been identified as a key foundation block to any form of PBC. The work in developing an asset management plan

[8] Design and Build and Public-Private Partnerships are considered outside the scope of this study.

provides significant benefit in terms of understanding the network, road users, risks, levels of service and the work required (both renewals and improvements) to deliver the required service levels. A commitment to improvement / enhance of asset management is therefore integral to PBC;

- Transparency in all aspects of the PBC process is required. Where the performance measures are appropriately defined (e.g. performance measured against set objectives and results clearly available to all including road users etc.), the ability to obtain payment without performance is greatly reduced;
- Sustainability of all parts of the supply-chain must occur (e.g. must be viable for the client and the contractor commercially but also able to grow / sustain / work force due to long-term nature of contracts);
- Performance measures that focus on outcomes and collected as part of "normal business" rather than performance monitoring becoming a business unto itself must occur;
- Certainty of funding, of performance, of measured value from outcomes is necessary to convince the public, private and road users of the value of the PBC;
- The level of flexibility built into the contract may (ability to change with changing needs of the network);
- Procurement is not too onerous on industry and focus on "value" not just cost, and is transparent and free to the extent possible from corruption. With PBC's the ability for corruption is greatly reduced once the contract is in place (fewer transactions, more visibility of levels of service etc.), and with the rewards in terms of the size and duration of the contracts being larger, the tendency is towards manipulation of the procurement process, rather than the delivery of the contract.

4. Key Benefits: While the findings around improved service levels, reduced costs, improved asset management, etc. are all as expected, the review identified a much stronger than expected benefit in terms of the socio-economic impact of PBCs. This is especially so where the DBMOT model has been in operation and the impact of the initial improvements to both condition and function has enabled for changes to the way society operates (e.g. provision of all-weather road surfaces to enable produce to get to markets etc.).

It was also observed that there is a lot of jargon involved with PBC, with different terms used for the same concepts, or different concepts covered under the same terms in different countries. Additionally the same term is used for significantly different contract forms in different countries. For instance the contract form referred to as Hybrid is a mix between Input/Output methods in some countries (e.g. India) and a mix between Output/Outcome in others (e.g. New Zealand). This lack of international consistency is undoubtedly playing some role in the confusion and slow uptake in PBCs in many countries.

4 TASK 2: DEFINING VARIOUS TYPES OF PBC METHODOLOGIES

4.1 BACKGROUND TO TASK

Defining a project as a PBC does not in its own right provide very much insight into the specifics of the PBC for the very simple reason that PBC is nothing more than an approach. As stated earlier in this report, performance-based contracting (PBC) is defined as "a type of contract in which payment for the deliverable is explicitly linked to the contractor successfully meeting or exceeding certain clearly defined minimum performance indicators." There are however a spectrum of PBCs (each with its own pros/cons and prerequisites for success). Even where the long term outcome is consistent, the state of the existing infrastructure can yield sufficient differences to make the PBCs quite different in nature.

Based on our own experience, it was premised that there are four scenarios under which PBC's are typically implemented, with these being:

A. The management of road networks that have pavements in a wide range of conditions from poor to good – Case A;

B. The management of road networks which have fallen into disrepair and require extensive reconstruction of the pavements before they can provide a reasonable level of service. – Case B;

C. The management of unpaved road networks, although it is recognized that with the much greater rate of deterioration (compared to paved roads) the outcomes are readily apparent, consequently they have proved much less complex to specify contractually. - Case C and

D. The management of road networks under public-private partnerships[9] – Case D.

[9] As noted previously, all PBCs rely on a public-private partnership to some extent, it is the level of private financing in the PPP model (Case D) that sets it apart.

While not necessarily a one-to-one relationship, the above road network scenarios have given rise to a range of PBC methodologies, each with its own particular strengths and weaknesses. More on these contract forms is given in Table 5 below.

4.2 IDENTIFIED PBC METHODOLOGIES

Table 5 presents the PBC methodologies identified as being in use. They represent a spectrum of contract styles from basic routine maintenance, through the design-build-maintain style, into alliancing and on through to public-private-partnerships.

Output and Performance-based Road Contract (OPRC) is a term that while having a specific reference to the sample Bank bidding documents (and therefore can be quite specifically defined), the term has become somewhat of a generic "umbrella" term for PBCs. It is therefore included in the table below in the context of the sample bidding documents.

TABLE 5: DESCRIPTION OF PBC METHODOLOGIES

Name	Description	Where Used
FIDIC – Input Format	Payment is made on the basis of the inputs (hours of labor, plant, quantity of materials used) etc. Under the input model it is very difficult to drive efficiency or effectiveness in the activities.	
Output and Performance-based Road Contract (OPRC)	The sample Bank contract model was developed for a situation where the road network may require some limited initial improvements, but overall is focused on the maintenance and renewal of the road network (hence the original limit to 30% of up-front work). Payment is based on four components of Maintenance & Management, Rehabilitation, Improvement, and Emergency Works. The OPRC was developed on the basis of the PMMR (refer below) with changes to address weaknesses in the PMMR model around the lack of an incentive mechanism to help drive performance and the view of the PMMR sample document as being impractical. In practice the OPRC has seldom been used in its pure form, and instead is typically modified to become the basis of a DBMOT contract to address Case B roads and for this reason OPRC has become more of an umbrella term for PBCs, than a specific model form. For instance in Andhra Pradesh while the sample OPRC model documents were used as the basis for the contract, they were modified to the extent that the contract is an input based contract and not Output or Performance-Based at all.	Developing countries receiving Bank loans, although seldom used without customization.
Gestion des Routes par Niveau de Service (GINIS)	Payment is made on the basis of the delivery of the agreed service levels (outcomes) and not the inputs or outputs required. The contractor has to maintain a road network, in good pre-established conditions, and	Chad

[Road Management in Service Level] And Performance Based Maintenance and Management of Roads (PMMR)	for the payment of a periodic fixed payment, defined by contract. The contractor is paid on the basis of a monthly kilometric fixed price which takes into account the initial upgrade work, as well as the management and the maintenance of roads. Only possible urgent works are paid on an input basis. In case where certain non-performance limits are reached, daily penalties are applied on the fixed price until the re-establishment of the level of service. The sample PMMR document was considered to have insufficient financial incentives for good performance and this was addressed with the OPRC (refer above) sample documents.	
NZ Hybrid	Under the NZ Hybrid model, a bid (client advised) quantum of renewal and rehabilitation work is completed on an Output basis, with all other maintenance activities completed on a lump sum for the Outcome required. Contracts are typically 5-7years 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 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.	New Zealand
Hybrid – World Bank	The Bank Hybrid contract contains a mix of Input and Output payment options, based on features of both method and performance based contracts. In practice there is limited scope for PBC concepts within the Bank Hybrid model as the contractor is only responsible for the efficiency of his/her operations.	
Managing Agent Contract	The MAC model has been used (with various iterations) by the Highways Agency in England for many years. While the MAC model has many of the aspects of a PBC, it does not have a direct linkage between performance and payment received, with the primary incentive for performance being the reduction in audit frequency and the avoidance of contract termination. The next iteration of the MAC, known as the Asset Support Contract (ASC) takes another step towards being a full PBC, with a much more outcome focused specification, but it still has no direct financial linkage to performance delivered. Although the ability to gain a contract extension has a much stronger performance basis to it.	England trunk road network
Performance Based Maintenance	The short term variation of the LTPBMC (refer below) where the focus is confined to the delivery of routine	

Contracts (PBMCs)	maintenance activities. Payment is on the basis of the performance delivered. As the contractor is not responsible for the long term performance of the assets, the performance in terms of durability measures is not practical.	
Long term Performance based Maintenance (LTPBMC)	Five year contract term, comprising preventative maintenance, asphalt overlays, addressing of backlog of works and general routine maintenance. Five types of interventions are included: 1. Routine Maintenance (RM) which includes minor patching and edge repairs, vegetation control is carried out annually. 2. Performance Based Maintenance (PBM) is carried out annually for carriageway works. 3. Back-log Maintenance (BL) is carried out annually mostly for drainage works. 4. Preventive Maintenance (PM) will be carried once for each road during the 5-year contract period unless traffic warrants otherwise. 5. Rehabilitation will be carried out for Bad sections once during the 5-year contract period typically during the beginning of the planning period.	Two contracts for 231 km were be let under ICB to test this form of maintenance in the Philippines.
Performance Specified Maintenance Contract (PSMC)	Under the PSMC, the contractor bids a lump sum (which is paid uniformly over the term of the contract) to deliver the performance requirements of the client. The contractor takes all risks associated with the quality and quantity of work required to meet the performance standards. The Contractor also has varying authority (dependent on specifics of the contract) to make asset management decisions on the network Typically 10years in duration.	Australia, New Zealand
Contratos de Recuperación y Mantenimiento Argentina (CREMA) [Rehabilitation and Maintenance Contracts]	CREMA contracts are a form of DBMOT (refer below) and typically involve two distinct phases of work: 1. Initial compulsory rehabilitation at sites identified by the Agency, including the minimum acceptable solution 2. Maintenance works according to contractual performance requirements, including routine, pavement and emergency maintenance The contractor is paid 5-10% at the start of the contract, rehabilitation on a lump sum basis (typically accounting for approximately 80% of the contract value), and the remainder on a monthly basis. Financial penalties are set for non-compliance at a level to deter the contractor from failing the standards.	Implemented in Argentina between 1997-1999 with five-year contracts. Network length of 100-300km
Design Build	Under this model, a single entity is responsible for the	

Maintain Operation Transfer (DBMOT)	full delivery of the project, with the agency providing the design and maintenance parameters that the road is to conform with. The model is typically applied where the network is in poor condition and there is a history of poor construction quality. By putting the upgrade works at the start of the contract period, the contractor has to ensure the quality of the design-build operations.	
Maintenance Alliance	Alliancing is a fringe PBC on the basis of the payment model. Payment is made on the basis of inputs required to deliver the agreed outcomes. Where the outcomes are delivered for lesser inputs than anticipated, the client and contracted parties share the benefit, and similarly when cost over-runs (or risks) eventuate, there is a sharing of the loss across all parties with the potential to only gain payment for the direct costs incurred (i.e. overheads and profit are at risk).	New Zealand for the Auckland Motorway Network
Integrated Service Agreement (ISA)	The ISAs are "Alliance Style" arrangements under which the full range of physical maintenance and professional asset management services are provided in a fully integrated manner, akin to "in-sourcing". The delivery of services is outcome based as outcome specifications are used for the works and each year an agreed quantum of work required to deliver the performance criteria and service levels is agreed along with the budget. To achieve their intent and purpose, the ISAs are structured to facilitate the integration of the services using an integrated team of Main Roads personnel and the Integrated Services Providers (ISP) personnel (including teams of Contractor / Consultant consortia). The integrated approach results in an arrangement where the division of Main Roads and ISP personnel is not visible (for example Main Roads and ISP personnel are be co-located, either in Main Roads‟ existing offices and facilities, or, where this is not possible, the ISP's offices and facilities). The contract term is initially for 5 years but there are ongoing extensions granted for good performance with no specified end date should performance continue to be assessed as appropriate. Payment is made on a reimbursement of direct cost plus margin and profit basis similar to Alliance contracts. A portion of the margin and profit is "at risk" each year as part of the performance modifier regime where penalties or bonuses can be paid for failing to reach or exceeding agreed performance targets.	Western Australia
Design Build Transfer	Under this model, the private business venture undertakes the detailed design (a specimen scheme is typically provided by the road agency to define requirements) and construction of the asset.	Internationally

	Payment is typically on an output basis upon completion of the works (with intermediary payments often included to minimize funding costs to the contracting entity).	
Public Private Partnership (PPP or P3)	Under the PPP model, the private business venture (often a combination of banks, contractors and consultants) provides a public service (i.e. the road) and assumes substantial financial, technical and operational risk in the project. Payment to the private sector may be directly by the user by way of tolls, or by way of payments from the road agency, with these often on the basis of availability of the road or on a per-vehicle basis.	Internationally

From the review in the table above, it is observed that in many cases it is only the local name of the contract that has varied and that the underlying methods and drivers are the same across many of the variants identified. The full range of PBC contracts can be summarized as follows, with the umbrella term for the PBCs involving the long term maintenance of road networks being OPRC. Four OPRC scenarios, reflecting the network needs exist as follows:

- Network Management: Where the road network is in stable condition, with elements of the network at all stages of the life cycle, the focus becomes on the delivery of maintenance and renewals with a notionally uniform level of work. There is no specific need for a significant upfront investment, and the aim is to deliver the levels-of-serve at least of whole-life cost;

- Design, Build, Maintain, Operate and Transfer (DBMOT): Where the road network requires a significant initial investment to bring it up to an acceptable condition, then the DBMOT model is appropriate. This situation is often associated with a history of poor construction quality and the focus is to get a better life from the assets being built, rather than necessarily delivering least whole of life costs. For that reason the renewal and rehabilitation works are often brought forward to the start of the contract, with the remainder used as a maintenance period to incentivize the contractor to improve quality standards; and

- Unpaved Roads: OPRCs have often delivered the greatest benefits for unpaved networks – particularly with respect to the social benefits of gaining all-weather access for remote communities to social services and to markets for their goods. While typically a variant of either the Network Management or DBMOT models, the rapid change in the condition of unpaved networks, the different risk models, and the lower cost to enter the market for contractors, all make for unpaved road networks to warrant their own category of OPRC.

- PPP: For those networks needing significant investment in improvements and additional funding from the private sector - Public-Private-Partnerships (PPP/P3), Toll roads and the like. These are in many ways extreme examples of the DBMOT model, and are not addressed in further detail within this study.

4.3 INPUT, OUTPUT, OUTCOME

While there are many contract forms with subtle differences, they all employ some combination of input, output and outcome payment models. These are discussed more fully below. In considering the contract forms both within the table above and in the discussion that follows, it is worth noting how the models impart responsibilities across the asset management value chain. The AM value chain (refer to Figure 23) identifies how the focus moves from Efficiency, through Effectiveness and on to Efficacy.

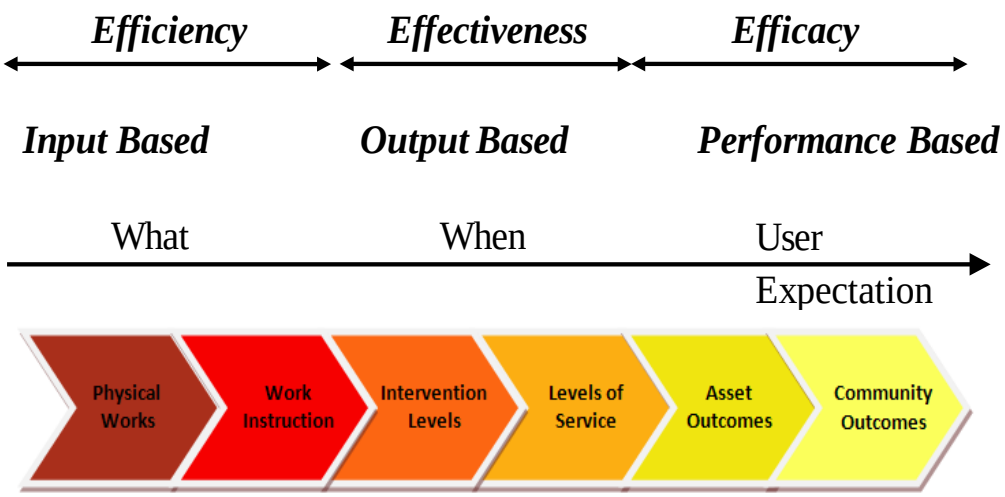


FIGURE 23: ASSET MANAGEMENT VALUE CHAIN (PORTER, 2002)

4.3.1 INPUT DRIVEN CONTRACTS

Historical practice in all the countries under study (and just about everywhere else) centered on input driven contracts which typically employed direct labor organizations undertaking works which had been tightly specified. This left little or no room for contractor innovation or efficiency savings to be made. Management and governance of the works was typically carried out by Highway Authorities in-house design organizations with little or no thought to any holistic approach to asset management of the network as a whole. The contractor simply did what he was told to do and received payment for labor and plant by the hour and for materials by quantity delivered. The focus was on getting the best service level one could for the available budget, often with unwritten secondary goal of employing as many people as possible!

As the benefits of outsourcing became apparent this model continued to find favor with the only change being the increasing use of contractors at the expense of in-house direct labor units. Experience from observing those managing this form of delivery model suggests a strong focus on the efficiency of the work force [as the contractor gets paid just for being on site, so the driver for those managing the contract is to make sure the resources are being used for the least time available] but rather neglected the effectiveness and efficacy issues that good asset management practices demand.

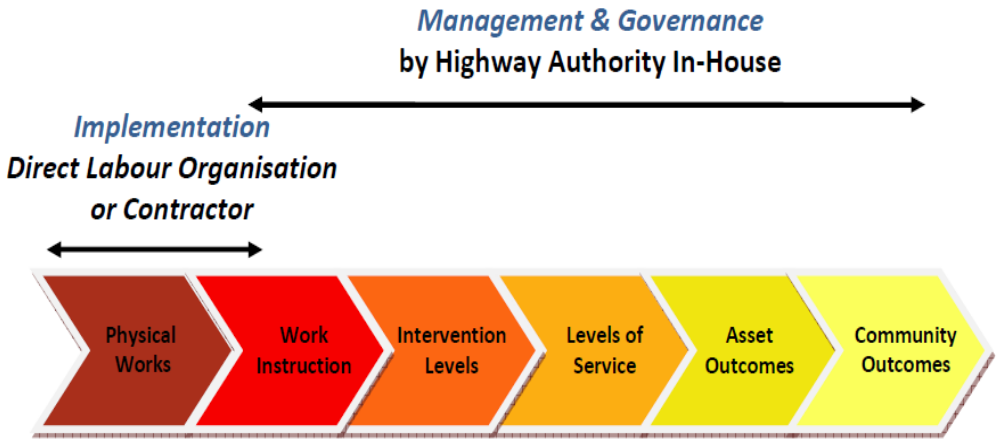


FIGURE 23: HISTORICAL PRACTICE = INPUT FOCUSED

4.3.2 OUTPUT DRIVEN CONTRACTS

Output based contracts were developed to encourage contractors to take responsibility for, and carry the risk of, the efficiency of their workforce. Under this model the contractor is paid for each of the completed outputs, rather than the resources used to deliver the outputs. Typically payment is for each completed unit of work (to accepted quality standards) in place or for larger works per cubic meter of material in place (the contractor carrying the risk of location). In more advanced models the contracting entity may be called on to take more of the risk so payment may be per square meter (with the contractor also carrying some of the design risk on depth).

While all the work on the network may be bundled up into one contract it is more common for the work to be broken down into a number of output based contracts such as routine maintenance, resurfacing, rehabilitation, and drainage improvements and let as separate contracts. The contractor should warrant their work so that the risk of rework is theirs as this helps to drive improvements in the quality of workmanship. The duration of the warranty varies but is typically at least a year or the duration of the contract in term contracts.

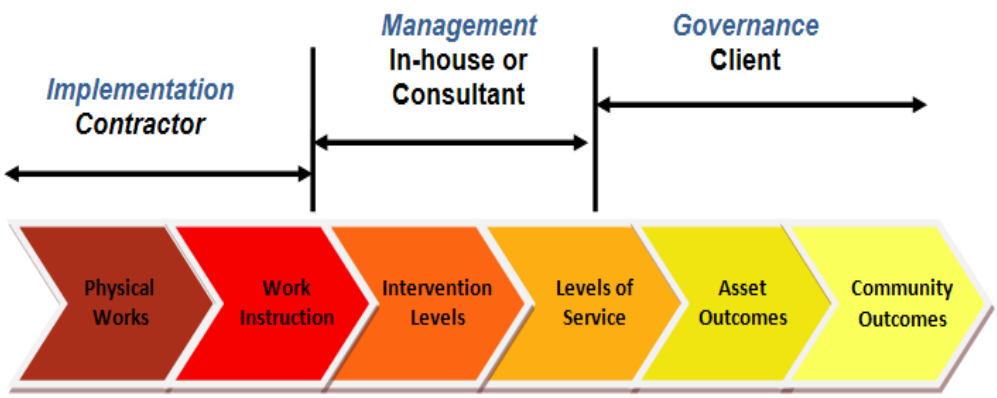


FIGURE 24: OUTPUT BASED CONTRACT

This model typically sees the separation of roles into three separate organizations (Figure 5) with the management role either being undertaken by the Agency's regional staff or being out-sourced to the consulting industry. This model has become known as the "conventional" or "traditional" model and is still in wide use today. Initially the management role was focused on supervision of the contractor but as Agencies have moved to embrace the principles of asset management the role has been extended to include data collection and analysis, condition assessments and predictions along with long term planning in developed countries. At the same time increasing reliance has been placed on the contractors own quality assurance programs and the level of supervision greatly reduced.

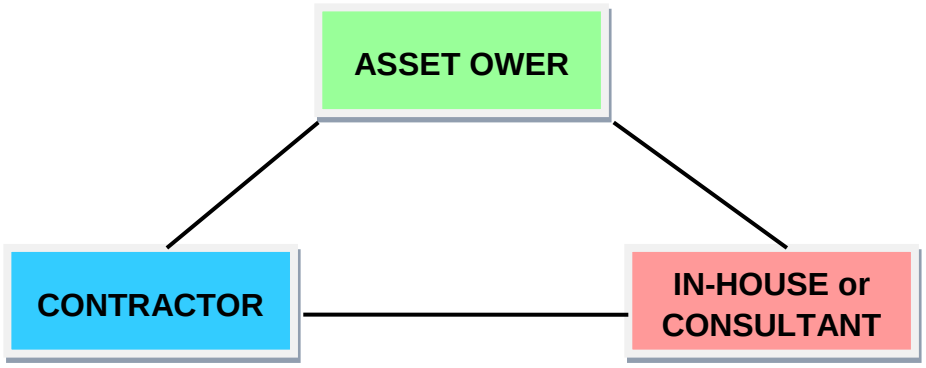


FIGURE 25: CONVENTIONAL OR TRADITIONAL MODEL

Work is still tightly specified within this model form providing little room for contractor innovation. Historically consultation with the contractor rarely took place before bids were invited meaning that construction techniques, health and safety issues or construction programs were not often adequately considered or the experience of buildability that a contractor could bring to the project taken on board. As this model has evolved the specifications have increasingly introduced performance based requirements and lump sum elements into their pricing.

As discussed above, the FIDIC suite of contracts includes for the use of Output based delivery models.

4.3.3 OUTCOME BASED CONTRACTS

The move to Outcome, or fully performance specified contracts provided a step change in the procurement of highway asset maintenance contracts. Arrangements are such that the Asset Owner simply enters into a single contract with a combined contractor/consultant organization and only specifies the desired outcomes [service levels] for the road network, placing full responsibility for all interventions including resurfacing and pavement rehabilitation, along with all routine maintenance activities, on the contracting entity. Accordingly the entity assumes full responsibility for both the efficiency and the effectiveness of all interventions. In their purest form these contracts allow complete flexibility in the methodology adopted by the contractor organization. In developing countries, the use of an experienced monitoring consultant to support the road agency is considered essential. The monitoring consultant also provides the contractor with an element of protection from interference by the road agency with regard to the methods the contractor engages to achieve the outcomes required.

These contracts provide the Asset Owner with one point of contact rather than the two typically used in the output driven or conventional form of contract. Payment is, for the most part, achieved under lump sum arrangements that significantly reduce the adversarial issues that can occur under the other forms of contract. Again, governance of the contract is the role of the client who is responsible for defining and ensuring compliance with the specified service levels.

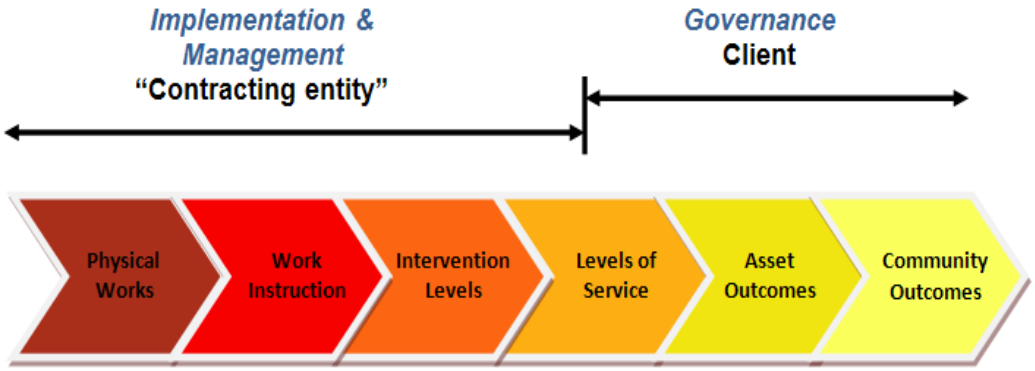


FIGURE 26: OUTCOME/PERFORMANCE BASED CONTRACTS

The required service levels are specified in performance based contracts through a series of performance measures which cover asset and contract management requirements, road user service and comfort measures as well as the long term durability of the asset. It is the later requirements that are the most contentious as agencies are understandably concerned about the consumption of their asset during the term of their contract. *Continuous improvement and innovation are at the heart of these contracts.*

Robust outcome based contracts demand good asset management practices. Indeed the preparation of these contracts necessitates the development of a stout asset

management plan. It is essential to have a detailed inventory of the asset; an understanding of its current condition, what condition and service levels are affordable over the long term as these forms the basis of the contract documentation. There is also a need to have an understanding of the network's risk profile so that management and mitigation of these risks can be equitably achieved.

Performance contracts come in many shades of grey as but there are three principle forms. They are:-

Performance Specified Maintenance Contracts (PSMC) – a truly lump sum contract where success is dependent on whether the contract documents prescribe the appropriate measures to achieve the desired performance. It requires the contractor to take full responsibility for all asset management and associated interventions.

Looking in more detail at the Performance Specified Maintenance Contract, these commissions cover a period, generally of 10 years, as it represents the typical life span of a bituminous surface and the economic life of major plant and equipment. It also provides a long enough period for an equitable transfer of some of the risk to the contractor. Through this form of contract the successful contractor is awarded a commission that is substantial enough to invest in and is able to manage its spending to meet the performance criteria for the least cost.

With the introduction of the PSMC contract a network maintenance contractor is not only appointed to take responsibility for all general maintenance of the highway network but also to undertake specialist functions such as pavement reconstruction and resurfacing. This makes the contractor responsible for the management of the network as well as delivery of the service in such a way as to meet contractual performance standards for a fixed contract price. It rewards the contractor who works efficiently and delivers a high quality product and offers savings through the reduction in duplication of management and supervisory staff and the elimination of rework. Under the PSMC model the network performance requirements are derived from the following areas:-

- Asset preservation
  - Pavement structure as measured with a falling weight deflectometer
  - Pavement cracking
  - Surface remaining life
- Pavement surface
  - Roughness
  - Rutting
  - Surface texture
  - Surface skid resistance
- Drainage systems
  - Pits
  - Culverts
  - Open Drains
- Traffic facilities
  - Traffic signs
  - Road markings

  - Barriers
  - Lighting
- Visual amenity
  - Litter control
  - Grass cutting
  - Tree maintenance
  - Weed management

The performance levels are generally defined with both a specified intervention level and a response time within which defects must be corrected. Under the contract the contractor is required to establish systems with which to measure and report on the condition of the asset. The Client retains an audit function on specific systems and outputs as well as annual audits covering all aspects of service delivery and achievement of the desired outcomes.

Output and Performance Based Roading Contracts (OPRC) or "Hybrids" as they are known in New Zealand. These involve lump sum payment for all routine maintenance activities and unit rates for the more periodic activities such as resurfacing and pavement rehabilitation (outputs). There is a wide variety in the manner in which the contractor is compensated for their outputs and the risk he is asked to carry. The role of the Auditor shown in Figure 28 may be aligned with an external Monitoring Consultant role if the industry is not sufficiently advanced.

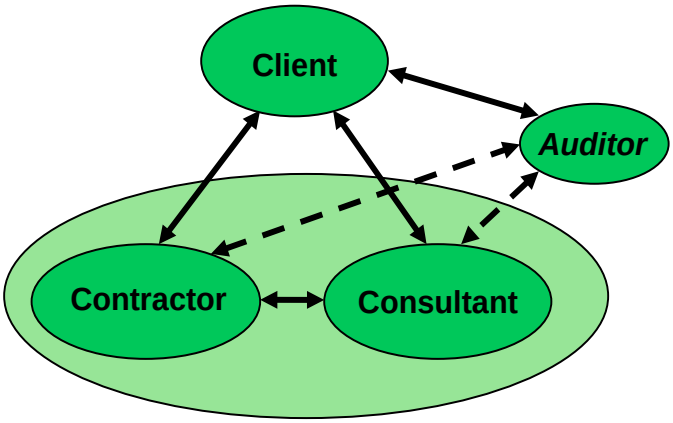


FIGURE 27: OUTPUT/OUTCOME HYBRID MODEL

Features of the Hybrid contract as used in New Zealand and the UK are:

- There is the potential for there to be no (or very little) pressure on optimal intervention, with the financial interests of the contractor not aligning to the best interests of the asset (or road agency). The contractor is inclined to promote schemes that maximize profitability unless work program is limited by underpinned lengths of the network to be completed each year. Within the NZ Hybrid arrangement, the agency (via its consultant) determines the quantum of works required to deliver the required asset condition, and then enables the contractor to choose where to undertake the works.;

- Can be adapted to allow for flexible annual budgets within reason – although there must be an equitable mechanism whereby an under investment in renewals by the agency would not result in the contractor being unduly penalized through higher maintenance costs;
- Client typically ends up 'owning' Asset Management Outcomes so it is important outcomes from interventions are defined in a way that drives good workmanship;
- Periodic maintenance may be undertaken under separate contracts in some jurisdictions;
- The consultancy role may be let separately, as is the case in New Zealand, or split between the agency and contractor as in the UK arrangement.

4.4 FIDIC CONTRACT MODELS

Federation of Consulting Engineers. The FIDIC acronym stands for the French version of the Federation's name (Fédération Internationale des Ingénieurs-Conseil). The best known of the FIDIC contracts are the Red Book (building and engineering works designed by the Employer) and the Yellow Book (M&E, building and engineering works designed by the Contractor). The original edition of the Red Book dates back to 1957. In recent years FIDIC has published many new contracts to complement the suite. The first of the new contracts was the Orange Book for design, build and turnkey works published in 1995. In 1999 FIDIC published a revised suite of contracts with updated versions of the Red and Yellow books together with a Green Book as the short form of contract and a Silver Book for turnkey contracts. More recently in 2005 FIDIC published an amended version of the Red Book for use by Multilateral Development Banks and in 2007 published a seminar edition of the Gold Book for Design, Build and Operate contracts. The first edition of the Gold Book was published in 2008. The Gold Book is intended for use where the contractor operates the asset in addition to designing and building.

The different forms of contract within the FIDIC suite are organized around the extent of design and other responsibilities assumed by the Employer and the Contractor. The suite is therefore now aligned with common procurement strategies rather than the nature of the construction works as shown in the table below:

TABLE 6: FIDIC SUITE OF CONTRACTS

Short Name	Full Name	Comments
Green Book	Short Form of Contract – First Edition 1999	Recommended for engineering and building work of relatively small capital value.
Red Book	Conditions of Contract for Construction for Building and Engineering works designed by the Employer - First Edition 1999	The Red Book has been revised to now be applicable to any construction works (not just "civil engineering') where the Employer carries out the design.
Red Book (MDB edition) – Multilateral Development Banks (Harmonized Version)	Conditions of Contract for Construction for Building and Engineering works designed by the Employer – MDB Edition 2005	The MDB edition of the Red Book simplifies the use of the FDIC contract for the Multilateral Development Banks, their borrowers and others involved with procurement, such as consulting engineers, contractors and contract lawyers.
Yellow Book – First Edition 1999	Conditions of Contract for Plant and Design – Build for electrical and mechanical plant, and for building works, designed by the Contractor	The yellow book provides for conditions of contract for construction works where the design is carried out by the Contractor.
Orange Book – First edition 1995	Conditions of Contract for Design and Build Turnkey	It is now more likely that an Employer requiring a design and build turnkey project under a FDIC contract would use a 1999 edition of the Yellow Book or Silver Book for Turnkey as they are more focused on the procurement strategies and less on the type of project (previously civil engineering and plant installation).
Silver Book – First Edition 1999	Conditions of Contract for EPC/Turnkey Projects	For use on process, power and private-infrastructure projects where a Contractor is to take on full responsibility for the design and execution of a project.
Gold Book – First Edition 2008 (Green Field Version)	Conditions of Contract for Design, Build and Operate Projects	This contract combines a design and build obligation with a long-term operation commitment in a 'green field' environment with a 20 year operation period

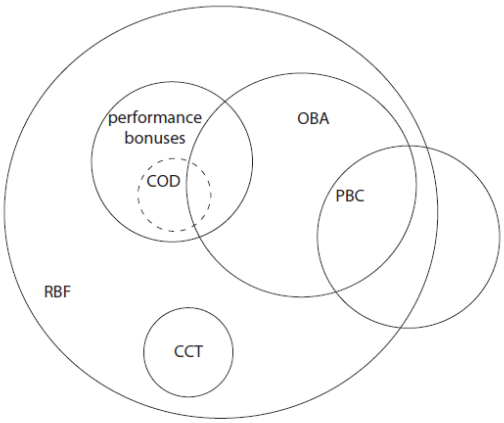
4.5 DESIGN AND BUILD

Design and Build (DB) involves the procurement of new works via a single contract, rather than the often comparable Design-Bid-Build model wherein a separate contract is let to complete the design phase, before the work is then bid for physical delivery. DB is often used in scenarios where the complexity of the job at hand requires a close collaboration between builder and designer.

While DB may well be a PBC model, the focus of this review is on the long term maintenance and operation of the network, and therefore DB contracts are excluded as they simply deliver an asset that meets the necessary performance requirements at Day-1 and not the ongoing maintenance and operation period.

4.6 OUTPUT BASED AID

Output-Based Aid (OBA) is a results-based mechanism that is focused to deliver basic infrastructure and social services to the poor. The OBA concept and initiative is a derivative of the Result-Based Financing (RBF) process that is aimed at incentivizing governments and their providers to engage service providers to provide infrastructure that is paid for on completion. Unlike traditional approaches, OBA links the payment of aid to the delivery of specific services or "outputs." For example, these can include acceptable distances from poor people's households to an all-season road or regional trade facilitation links. PBC initiatives can be enhanced if incentives, subsidies or capacity building are needed using the OBA mechanism that can be effectively utilized to assist the successful completion of PBC projects. The basic relationship among PBC, OBA and RBF displays in Figure 29.



Source: Authors' representation.
Note: CCT = conditional cash transfer; COD = cash on delivery; OBA = output-based aid; PBC = performance-based contracting (for example, for roads).

(Source) Mumssen et al, 2010, p. 4

FIGURE 28: THE RELATIONSHIP AMONG PBC, OBA AND RBF

PBC in the road sector is a good example of RBF, with payment related to successful accomplishment of the project objectives. PBC is a good example of how a results-based system works to the advantage of providers and users. The OBA approach can assist in facilitating the change of contracting methodology and building of confidence and knowledge for this more efficient way of procurement. According to Hartwig et al (2005), the Chad PMMR pilot project, one of the PBC mechanisms, channeled subsidies to the delivery of mutually agreed level of services of rehabilitation, maintenance and operation of the designated rural roads. Namely, this project shows one of the best examples of the linkage between access to roads and poverty reduction (p. 2). It also stimulates innovation towards efficiency as the risk and opportunity for invention are heightened leading to reduced costs. For example, Argentina CREMA, one of the PBC approaches, had encouraged to promote innovation "in the programming and execution of works" because the payment is reflected to outputs and it could substantially improve road conditions from 25% to 5% in the ratio of poor conditions while keeping the budget within the agreed budgets (Liautaud, 2001, p. 44).

OBA can assist PBC to become more effective but also to be easier to implement. For example, in overcoming the resistance to change issues through facilitated institutional strengthening. Some PBCs do not reach operational activity as their promoters are unable to surmount the obstacles of vested interest; contractor resistance, acceptance of risk, and acceptance of change (refer to Section 7). On the other hand, according to the comprehensive analysis of OBA approaches, a successful OBA implementation can lead to the increase of transparency, accountability, engagement of private sector capital and expertise, innovation and efficiency, and sustainability of public funds (Mumssen, et al, 2010). The WB-OBA initiative may be able to facilitate reductions to these hurdles.

Another area where OBA could assist is in contractor training and facilitation. The issues arising for contractors wanting to participate in PBCs are in capacity building to be able to participate with confidence in the new procedures, for example understanding risk transfer and facilitating access to finance as is the inclusion of WB in the financing giving a less risk scenario to national lending institutions. Also, countries which OBA approaches are highly required also tend to lack the capacity of implementing the approaches, because the scope of target of OBA is the poor. OBA focuses on "targeted training, hiring of independent verification agents, involvement of NGOs, and private administrators to manage universal access funds" for building capacity (Mumssen et al, 2010, pp. 47-48,). Such know-how of WB-OBA initiative might be able to contribute to the capacity building of road agency for implementing PBC projects.

Definitions:

Output-based Aid (OBA) is a financing approach to increasing access to basic services for the poor in developing countries. OBA is used in cases where poor people are being excluded from basic services because they cannot afford to pay the full cost of user fees such as connection fees. OBA is one of a spectrum of results-based instruments. It is part of a broader donor effort to ensure that aid is well spent and that the benefits go to the poor. Under an OBA scheme, service delivery is contracted out to a third party, usually a private firm, which receives a subsidy to complement or replace the user fees. The service provider is responsible for "pre-financing" the project until output delivery.

The subsidy is performance-based, meaning that most of it is paid only after the services or outputs have been delivered and verified by an independent agent. The subsidy is explicitly targeted to the poor

Results-Based Financing (RBF) encompasses a range of mechanisms (which include OBA and PBC) designed to enhance access to and delivery of infrastructure and social services through the use of performance-based contracts.

RBF mechanisms have in common that a funding entity (typically a government or sub-governmental agency) provides a financial incentive, reward, or subsidy, conditional on the recipient undertaking a set of pre-determined actions or achieving a pre-determined performance or outputs. Resources are disbursed not against individual expenditures or contract milestones on the input side, but against demonstrated and independently verified results that are largely within the control of the recipient.

RBF applies some core concepts from OBA to broader development problems, not necessarily associated to the issue of affordability or access to services by low-income populations, the defining characteristic of OBA

4.7 UNPAVED ROADS

Unpaved roads provide a unique application of the PBC methodology, and one where some of the most consistent success stories originate from. While the over-arching methods and theories are equally applicable, they have a number of specific benefits and challenges that need to be addressed, including:

- When an unpaved road is not maintained in a developing nation, access to markets and essential services may be completely removed from parts of society. The social benefits of having an appropriately maintained unpaved network can often be significant;

- Owing to their relatively fast deterioration the outcomes are generally easy to specify and are focused on the road user comfort measures, which in turn make the opportunity for corruption much less;

- While there is an issue around the specification of appropriate durability measures for unpaved roads to account for gravel loss, they have been successfully implemented in a number of countries. Approaches using a combination of metal depth, plus a minimum quantity of replacement metal tend to provide an acceptable means of ensuring durability – although the typical quantity of metal being replaced is less than 1 stone depth deep;

- Given the performance indicators change quite quickly on unpaved roads (both in terms of deterioration and rectification (via grading)) this has to be considered when evaluating the performance and contractual compliance;

- The cost of entry by industry into unpaved network maintenance is relatively low, with simple equipment required;

- The risks are easily identifiable and generally easily managed as the asset is not hidden.

These findings are consistent with those identified within Tanzania (Ako, 2011) where 1,100 kms of un-engineered gravel roads have been managed under a PMMR since 2007, it was noted that:

For unpaved roads, many of which are un-engineered, delay in maintenance can very quickly lead to serious effects on driving quality and passability especially in the wet season.

The PMMR approach differs from the traditional Bill of Quantities maintenance in that a Contractor assumes the responsibility and risks of managing and maintaining a number of roads to agreed standards for a period of five years and in being oriented towards road users' satisfaction, summarized in driving quality and average speed. The PMMR approach normally includes some initial road repairs to bring the roads to maintainable condition. For the above contracts it was originally estimated that 20-30% of the roads would require such repairs; however, due to the prolonged tender period this increased to 75-100% for the different contracts….

The Initial Rehabilitation Works were to be completed within the first two years of the contract. For the PMMR contracts in Mwanza and Rukwa Regions the Initial Rehabilitation Works were finished over 12 months ago in the 1st quarter of 2010 and all roads are now under maintenance only for the remainder of the contract period, while Tanga Contractors are still undertaking Initial Rehabilitation Works.

The Contractor's performance is closely monitored and every month checked to confirm that he has attained agreed Service Quality Levels on the roads in his contract.

There are detailed service quality level criteria that he must fulfil including all year passability, number and depth of potholes and corrugations, average comfortable driving speed, height of vegetation and cleanliness of ditches. If he does not fully achieve the specified Service Quality Levels – for example a required average driving speed of 60 kms/hour – he is penalized in terms of reduced monthly payments.

Results of the Project at Mid-term

At mid-term the PMMR approach to maintaining roads has proved effective in Mwanza and Rukwa Regions. Due to the rigorous monitoring of achieved Service Quality Levels and a regular Contractors' presence on the roads to promptly repair defects as they occur, the PMMR Pilot Project has resulted in better quality unpaved roads on a continuous basis and also above the TANROADS road quality classification "Good". Maintenance in the Tanga contracts is not yet to the same quality. This is attributed mainly to:

i) Lack of adequate training of the Contractors in PMMR;
ii) Contractors not having the same level of experience as the Contractors in Mwanza and Rukwa;
iii) Contractors both permanently based outside Tanga Region (unlike for Mwanza and Rukwa Contractors), affecting quality of contract management and availability of equipment to quickly repair defects.

Travel Time:

- *Roads are now passable all year round and average driving speed is much higher. Consequently travel time has shortened significantly as shown in the following table for selected roads.*
- *Vehicle operation costs have clearly been reduced and it has been indicated that this has led to a reduction in passenger fares on bus lines on some roads.*

Affordability:

- *TANROADS compiles information about unit rates for different types of maintenance in the regions of Tanzania. Average unit rates for maintenance works on unpaved roads undertaken in 11 regions during 1st quarter of FY 2010/11 have been used to estimate maintenance costs per kilometer if the traditional approach were used to maintain roads to the same quality level as the PMMR approach provides.*
- *The data shows maintenance by PMMR is within the Road Fund budget allocation for roads of service level "Fair". It also demonstrates that the costs for traditional BOQ maintenance are significantly higher if the unpaved roads were maintained to a comparable quality service level.*
- *The PMMR approach is superior to the traditional BOQ approach with respect to road quality and affordability.*
- *The PMMR maintenance approach is contingent upon first bringing the roads into maintainable condition. It is estimated that this initial rehabilitation would cost an average 20% increase in annual maintenance costs for a 5 year period by a careful selection of roads to be included into the PMMR system. For*

succeeding PMMR contracts on the same roads this cost would naturally be zero.

- *By following a carefully controlled road improvement program it should therefore be possible to eventually integrate all roads into the PMMR system within the Road Fund budget.*

4.8 OBSERVED CRITERIA FOR THE SELECTION OF PBC METHODOLOGIES

The study team set out to identify the criteria used for the selection of each of the OPRC methodologies (Network Management, DBMOT and Unpaved). In practice it was not possible to discern amongst the methodologies on the basis of the criteria envisaged, namely items such as;

- Impact on local competition/capacity
- Capacity of the industry and size of contracts
- Risk transfer
- Ability to deal with corruption
- Desire to be innovative
- Maturity of the network (flexibility to handle changes as new assets are developed)
- Knowledge of PBC concepts by client
- Historical maintenance and asset data
- Reliability of traffic data and control of overloading
- Value of initial betterment works
- Availability of funds (non-uniform)

Instead, these items were all found to be aspects that needed to be addressed to ensure the success of any OPRC, and that instead it was the needs of the network that defined what is the appropriate contract model form.

4.9 MATURING BETWEEN PBC METHODOLOGIES

While there are some preferred PBC methodologies for any given state of a road network, it is a reasonable assumption that the intent of all contracts is to move the network towards a state of being in a generally good condition. Therefore, it is logical to vary the form of contract as the network condition changes (owing to the specific nature of unpaved networks, the network can often make the transition to the state of good condition without the need to fundamentally change the contract form).

The progression for paved roads is typically from a DBMOT model to bring the network out of a state of poor condition; then into a Network Management to retain the network once the condition has reached a sustainable level. The ability to progress is also restricted by the asset management understanding by both the road agency and the contracting industry. This reiterates the need to ensure that all parts of the supply chain understand asset management, as well as the specific delivery model in use at any point in time.

5 TASK 3

OUTLINING PBC'S STRENGTHS AND WEAKNESSES

5.1 BACKGROUND TO TASK

As with any contract model, each of PBC models have particular strengths and weaknesses which means that care needs to be taken to ensure that the correct model is chosen, or indeed the selection of a non-PBC may be appropriate in some situations. This task used the findings from the interviews, literature review and the personal experiences of the study team to identify the relative strengths of each of the models in dealing with a range of factors.

5.2 FINDINGS FROM TASK

Based on the interviews and literature review, each of the PBC generic model types have been rated in terms of High, Medium or Low (H/M/L) impact against a range of factors. Whether each of the factors is considered strength or weakness is in many cases subjective – for instance the ability of a PBC to reduce political interference may be seen as either a strength or weakness depending on where in the organization one is based.

TABLE 7: OBSERVED STRENGTHS/WEAKNESSES OF EACH PBC MODEL

Strength/Weakness Factor	Network Manageme nt	DBMOT	Unpave d
Improved Workmanship: Where the contractor has a financial incentive to ensure that the quality of the physical works is delivering the least whole of life (or more likely whole of contract) cost solution.	H	H	H
Consistency of service to the road user: Direct labor solutions, or the use of input/output contracts, tend to focus on balancing of the cost of service, whereas OPRCs focus on balancing the quality of service (with the contractor balancing the cost).	H	H	H

Strength/Weakness Factor	Network Management	DBMOT	Unpaved
Less corruption: Because of the duration of PBCs and scope (larger contracts) the number of contractual "transactions" are reduce thus reducing opportunities for corruption. Additionally, given the performance element of PBC, expected LoS can be communicated with communities affected by the network. The public involvement can be utilized to help ensure the contracted performance levels are met. This is particularly true for those measures that are defined on a quantity basis (e.g. x potholes per km) rather than the use of response times.	M	M	M
Encourages Innovation: This really depends on the duration of the contract and what risk allocation model is in place. Short term contracts, or during the latter part of long term contracts, the drivers for innovation are often greatly reduced as the pay-back to the contractor is beyond the contract term. A secondary aspect is who benefits from the innovation – is it the contractor, or is it shared with the client (who in turn shares with industry). A forced sharing of innovation can also decrease the incentive to innovate.	M	M	M
Risk sharing encouraged: The appropriate allocation of risk, and the definition of a clear and equitable risk boundary, is essential to the success of an OPRC.	H	H	M
Financing required from private sector: The financial success of the Network Management and Unpaved models tend to be on the basis of that the contractor does not have to provide significant cash-flow to the project. This therefore lowers the cost to the road agency, and also lowers the financial exposure of the contractor. The DBMOT model is designed around the need for financing.	L	M[10]	L
Least whole of life cost achieved: While all focus on improved workmanship, the DBMOT model often forgoes some of the whole-of-life benefits in order to achieve the maximum maintenance period on the works. This is achieved by front loading the renewal/improvement works at the start of the contract, even when the existing assets may have 2 or 3 years life left in them.	H	M	H

[10] The DBMOT payment model may pay for the initial works on either an output basis at the time of completing the works, or via a deferred payment over the term of the contract (thereby requiring the contractor to provide financing). In any case, the DBMOT model likely has a sufficient peak of work in the earlier period of the contract that there will be relatively high cash flow issues on a month-to-month basis prior to the outputs being completed (and payment made).

Strength/Weakness Factor	Network Management	DBMOT	Unpaved
Impact on existing players: Because the Network Management and Unpaved Roads models do not require financing from the private sector, the move to these models from prior Input/Output contracts is manageable. For the DBMOT model, the need to provide significant equity to the contracts may be beyond existing contractors.	M	H	M
Requires strong governance by client: Owing to the complexity of assets (in particular the management of the durability of the pavements) in the Network Management and DBMOT models, there is a need for a very strong client governance team. For the Unpaved road network, the lower level of complexity and relatively easier management of defects enables for a lesser standard of governance/management on the client side.	M	M	M
Retention of control by client in the FWP decisions: The ability of the client to direct works can be both a good and a bad thing. The Network Management and Unpaved Road models are generally more open to client involvement in the FWP decisions, as there is not the same complex financial model involved. For the DBMOT, the client has practically handed all control over to the contractor, and while variations may be negotiated, the process is much more complex.	M	L	M
Relative cost to procure for the client: Network Management often costs more as the client is typically more fully conversant in asset management, and therefore seeks to control more aspects of the overall services. The contractor is expected to take on a broader range of risks and deliver a consistent quality of service. The DBMOT model is often slightly easier for the client as there is less focus on the historic construction issues, as the contractor is effectively rebuilding any "at risk" assets. Unpaved Roads are generally lower cost because of the simpler nature of the assets involved.	H	M	L
Reduced political interference: All OPRC contracts make it harder for politicians to interfere in the determination of what works to do and when. The focus on service standards, and not on inputs/outputs, means that any political influence needs to start with a discussion about the service standards to be delivered across the network, and not on a specific project.	M	M	M

6 TASK 4: CLARIFYING VARIOUS TYPES OF PBCS AND FIDIC (INPUT/BOQ)-TYPE CONTRACTS

6.1 BACKGROUND TO TASK

In broad terms each PBC contract model can be summarized as having some combination of input, output and outcome based payment mechanism. A discussion on the principles of input, output and outcome contracts is presented in Section 4.3.

Additionally, depending on how the "performance" part of the PBC is set up, the contract models each have a different potential to incentivize the contractor to focus on efficiency and effectiveness. Efficiency is in many ways akin to getting the inputs/outputs at the lowest unit cost – generally achieved by providing a contract that enables for the high utilization of resources. Effectiveness savings are obtained where the contractor considers the whole-of-life costing (life cycle cost) of the asset, and the contractor makes profit by minimizing these long term costs.

Each contract form can also have significantly different results depending upon simple factors such as:

- Payment model;
- Maintenance specification (especially comparing "response times" to "density of defect" approaches)
- Levels of service; and
- Risk allocation.

For example, the Bank's standard OPRC model is modified each time it is used through the adoption of different responses to the above items. It is therefore not possible to draw conclusions at a detailed level on the differences between the models, but it is possible to understand the primary drivers that each PBC model delivers.

6.2 KEY FINDINGS

For each of the contract methods discussed in Task 2 (refer to Section 4) and the factors listed in Table 7 we have sought to identify the contractual limitations of each model, with the results presented in Table 8. Where the contract model does not determine the impact (but rather the application around the issues noted in the bullet points above does) we have noted that in the table to indicate that the impact and variation often noted, is more about the nuances of the implementation than the overarching model form.

TABLE 8: ASSESSMENT OF THE MODEL TYPES

Criteria for Selection	FIDIC Input	FIDIC Output	Unpaved	Network Management	DBMOT
• Makes significant use of input payments	Yes	No	No	No	No
• Makes significant use of output payments	No	Yes	Yes	Yes	Yes
• Makes significant use of outcome payments	No	No	Yes	Yes	Yes
• Encourages efficiency	No	Yes	Yes	Yes	Yes
• Encourages effectiveness	No	Yes	Yes	Yes	Yes
• Impact on local competition/capacity	Depends on the extent of the network controlled under the PBC and rules for the subcontracting of work locally. Typically the PPP will have the greatest duration of impact, but will equally be for the smaller network length.				
• Capacity of the industry and size of contracts • (see note 1)	Requirements on capability of industry generally lower than other models			Industry needs to understand asset management for these to succeed	
• Risk transfer	Increase in risk transfer as moving across the table, with the PPP (beyond the DBMOT model) transferring most risks and the FIDIC Input transferring the least. Each contract can have large variances as a result of the risk allocation included. At a higher level, Input contracts transfer very few risks; Output contracts transfer the risks associated with efficiency of delivery; and the Outcome contracts transfer the risks of effectiveness and quality of workmanship.				
• Ability to deal with corruption	Difficult as a large number of transactions are involved.			Generally better owing to the limited number of transactions	

Criteria for Selection	FIDIC Input	FIDIC Output	Unpaved	Network Management	DBMOT
• Desire to be innovative	Depends on the risk sharing in the contract. Long term contracts (typically the OPRC/DBMOT/PPP) often have a greater innovation incentive, however even in these contract models there may be little innovation if the risk of failure lies solely with the contractor.				
• Maturity of the network (flexibility to handle changes as new assets are developed)	Very easily handled, as contractor is not taking the risk on work quantum		Manageable		
• Roads in a wide range of conditions	Easily handled	Easily handled	Easily handled	Not ideal as tends to discard residual life in existing assets at start of contract	
• Roads in a generally poor condition	Easily handled	Easily handled	Not ideal as payment profile doesn't match work	Ideal – if the agency has funds available, then potentially the DBMOT model may be better than the PPP, which is ideal if significant upfront investment is needed and funds are not available.	
• Unpaved roads	Easily handled				
• Knowledge of PBC concepts by client	Limited knowledge needed			PPP has highest knowledge requirement by the client owing to the much harder ability to vary the contract at a later date.	
• Historical maintenance and asset data	Not an issue as risks are retained by the client		Depends on the risk allocation model, but typically need a good data set to reduce risk pricing.		Depending on the level of upfront work, this may not be an issue as PBC contractor will be renewing assets.

Criteria for Selection	FIDIC Input	FIDIC Output	Unpaved	Network Management	DBMOT
• Reliability of traffic data and control of overloading	Not an issue as risks are retained by the client			Depends on the risk allocation model. Industry often has large concerns about overloading even when they understand it is not their risk.	
• Value of initial betterment works	Not an issue to the contractor			Can readily handle upfront betterment works.	
• Availability of funds (non-uniform)	Not an issue to the contractor			Is an issue	Is what the model is designed for.

Note 1: For large PBCs, the local contracting industry is less critical to the success of the PBC as an experienced national or international contractor will likely lead a team (using local smaller contractors to deliver much of the service). Where there is a desire to ensure a portion of the work is undertaken by local firms, and then this can be included as a contractual requirement and subject to monitoring throughout the term of the contract. While it may appear desirable from a local or national viewpoint to restrict the size and/or scope of the PBC to align with the capacity and capability of the domestic contracting industry, such an approach should be cautioned against

Based on the projects reviewed, it was not possible to identify specific factors or situations that lead to the selection of one form of contract over another. Instead, the condition of the network and access to funds largely dictated the contract model. For instance, where significant upfront work is required and the road agency has funds available, then the DBMOT methodology is often favored, while the absence of agency funds may shift the same network into the PPP model type. Similarly, a network in reasonably good condition may be managed under an OPRC style contract, or via an Output or PPP model.

6.3 CONCLUSIONS

While there are many contract models in use, in practice these all combine some combination of input, output and outcome payment methods. Where asset management is well understood by both the client and the supply chain (consultants and contractors), there tends to be a greater use of outcome payment options, while the converse is true in terms of the use of input methods.

Output contracts offer the greatest flexibility to the client to address changes to service levels, network scope or otherwise. However, this flexibility comes at the

cost of being able to incentivize the contractor to focus on the effectiveness of his actions and the surety of costs associated with a long term outcome based contract

TASK 5:

7 DISCRIMINATING BETWEEN SUCCESSFUL AND LESS SUCCESSFUL PROJECTS

7.1 BACKGROUND TO TALK

The purpose of this task is to identify what are the key aspects that separate out a successful from a less-successful PBC project. At the commencement of the project it was expected that a number of key factors would be identified that would determine whether or not a PBC was truly successful. As the project has progressed, it has become apparent that in most cases the failures associated with PBC are not during the delivery phase, but rather in the steps required to implement a PBC.

This task has therefore set out to identify what are the keys to successful implementation of a PBC. Also included into this task is work completed to understand why the governments of Poland and Egypt have refused to adopt PBCs to date – notionally a countrywide failure from the perspective of PBC implementation.

7.2. STEPS TO SUCCESS (PBC IMPLEMENTATION CHAIN)

To yield an overall successful implementation of a PBC, the project needs to first move through a number of prior steps, all at which failure to progress would preclude the eventual letting of the PBC project. The broad steps involved are indicated within Figure 30. While success is ultimately measured via the results delivered on the road, observation is that most of the perceived "failures" of PBC projects occur much earlier in the chain i.e. the PBC itself did not fail, but the process to implement a PBC did. Overall, it is found that very few PBCs have failed within the final link on the PBC Implementation Chain.

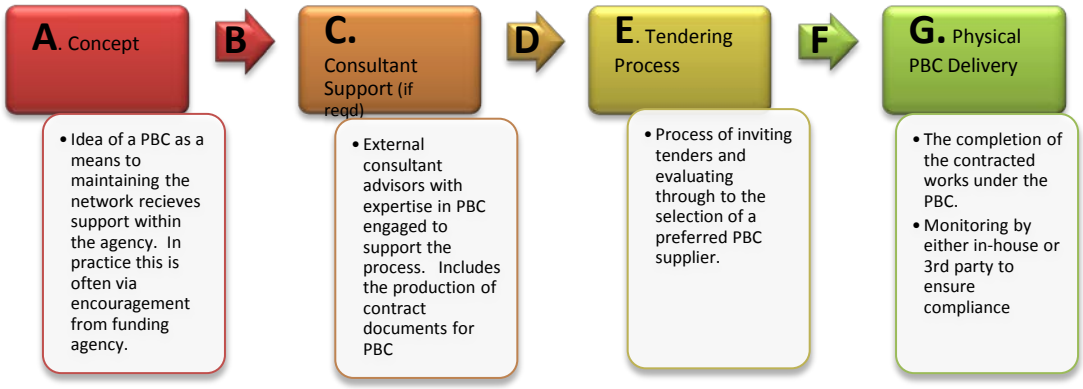


FIGURE 29: PBC IMPLEMENTATION CHAIN

Within Figure 30, seven distinct potential points of failure are identified (labeled **A – G**). Discussion on each of these is had in Table 9 below in terms of the nature of failure, and what might be possible to help alleviate the reason for failure (or increase the chances of successfully moving to the next link in the implementation chain).

TABLE 9: EXAMPLES OF FAILURES AT THE VARIOUS STEPS ALONG THE CHAIN INCLUDE

Link in Implementation Chain	Discussion	Indicative Alleviation Measures
A. Failure of Concept	It is almost impossible to know how many transport agencies have considered implementing a PBC but have not advanced the concept any further. Of those that have failed to move past the concept, the Polish example (refer Section 7.3.2) is possibly indicative of many.	Better Bank guidance on the benefits of the asset management approach and a full suite of PBC sample bidding documents available, including a clear selection criteria for each model type and some factually based analyses of the value delivered by the PBC model. This would extend to the collating of statistics on the relative cost /km/yr of managing roads under various contract models (taking into account the variation in service levels). Help with the process of developing the objectives of the road agency, and then linking these to the most appropriate contract model form(s). It should be noted that PBC contracts are not always the best means for achieving different objectives targeted by the road agency. Therefore, there has to be a natural fit between the objectives of an agency and the PBC mechanisms. There has to be a champion within the organization to drive the PBC concept within the organization. Someone has to take ownership of the transition into a different procurement process.

Link in Implementation Chain	Discussion	Indicative Alleviation Measures
B. Failure to move from Concept to Consultant Support	Practically this is almost indistinguishable from the failure at stage A, with the only notable difference being that the discussion on the concept has been made somewhat more public and/or discussed with lending institutions such as the Bank. Failures at this stage appear to be via procurement issues of the consultant support. For instance Thailand had terms of reference for the appointment of a consultant prepared in 2004, but has not yet initiated this. Similarly Punjab required two rounds of bidding to yield a result.	As above. Also a standard Terms of Reference for the consultant support to suit the case at hand, supported by a clear training suite of materials that explain the concepts. The TOR should require for the delivery of a draft Asset Management Plan that would provide a benchmark cost comparison for whatever form of PBC was subsequently decided upon.

Link in Implementation Chain	Discussion	Indicative Alleviation Measures
C. Failure of the appointed Consultant	At this stage in the process failure is a combined consultant/client affair wherein the consultant is unable to produce contract documents that are suitable in the eyes of the client/Bank for progressing to the bid phase. This problem is currently exacerbated by the limited number of consultants with appropriate experience and expertise. The initial consultant support in Botswana was not successful in advancing the contract and a new bid process is under way to identify a replacement.	The reluctance to use a high selection weighting on non-price attributes means that in many cases the client may well be receiving advice from a consultant that has limited (if any) specialist knowledge in the field of PBC. The use of lowest cost evaluation methods tends to force the use of contract staff not necessarily skilled in OPRC/PBC. Either a two-stage evaluation process to shortlist only capable/experienced consultants, and/or placing a much higher weighting on non-price attributes would reduce the chances of this occurring. Additionally, the availability of a suite of standard Bank sample bidding documents to address OPRC, DBMOT, P3 and Unpaved road networks would result in a lesser burden on the consultant to develop one-off contract documents.

Link in Implementation Chain	Discussion	Indicative Alleviation Measures
D. Failure to move to the Bidding Process	At this stage, failure is often caused by an inability to obtain the necessary funding commitment to deliver the physical works. In many cases it is thought that the apparent higher cost estimate of the PBC (compared to traditional contracting means) is as a result of the consultant proposing design/construction standards that will deliver least whole-of-life cost solutions. Where the work is potentially moving from in-sourced to outsourced, this issue is further exacerbated by few agencies recognizing the true cost of delivering the services (overheads etc.).	Bank to develop better support/guidance around the actual quantum of work and design/construction practices necessary to minimize the whole-of-life costs of ownership of the asset. It is against this value that the PBC should be measured in terms of delivering value for money, and not the prior underfunded scenario that occurs in many jurisdictions. Undertake industry consultation to determine the viability of the model and engage with industry. This is particular important to help manage perceived risks such as historic construction quality and vehicle overloading.
E. Failure of the Bidding Process	Very few PBCs have failed at this stage. Two notable exceptions are Egypt (refer Section 7.3.2) and Argentina. In Egypt the timing of the PBC coincided with a capacity constrained market that had ample work from construction contracts. Consequently only a single bid was received (from the 10 invited). In Argentina, the financing cost to the contracting industry of the high quantum of upfront works versus the proposed uniform payment resulted in excessive prices. Argentina subsequently moved on to a successful PBC with the CREEMA contract model.	Better support to help select the most appropriate contract model (PBC or otherwise) would reduce the chances of the bid prices coming in well above client expectation. More industry involvement early in the process through briefings, seeking feedback and explanation of the benefits to their long-term sustainability as contractors that these types of contracts can offer. This could in turn help increase interest in, and knowledge of, the contract form and reduce cost bid as industry understands risks better.
F. Failure to Sign the Contract	We are not aware of any PBCs where the preferred contractor has not gone on to sign the contract.	

Link in Implementation Chain	Discussion	Indicative Alleviation Measures
G. Failure in the Delivery of the PBC	At this stage, failure is either not achieving full compliance with the contract requirements or as a result of financial difficulties on the part of the contractor owing to an under-pricing of the works (or risks). Where the contract has been under-priced (more likely on a lowest price bid selection criteria) the potential for major performance challenges and intervention by the agency is greatly increased. To help ensure compliance, it is essential that penalties are timely and comparative to the level of non-conformance. The concept of the "Non-Conformance Report (NCR) Bucket" as outlined in Opus (2009) is considered an approach that is readily understood and provides the appropriate level of tension on the contractor's performance. Penalty regimes that work on a "three strikes and you're out" principle have generally not worked in either the developed or developing world.	The selection of an experienced management consultant (if in house skills don't exist) would reduce the chances of failing to comply with the contractual requirements. Ideally the consultant selected to support the bid process should be retained for the first 1-2 years (minimum) after contract award to ensuring continuity of service and maximize the chances of contract success. Making an effort through the whole procurement development process to keep industry informed, seek feedback and educate them on the model form, such that expectations are known before the contract is commenced/bid. The chances of financial failure of the contractor can be reduced by recognizing the financial strength of the bidding party in the evaluation process, and by ensuring that the risk allocation table (refer to Table 4) is equitable. While a low bid price may appear attractive at day-1 of a contract, an unsustainably low price often leads to dissatisfaction by all contracted parties. The use of a quality based selection process for the delivery of the physical works is also necessary to minimize the risk of financial default by the contractor.

If a PBC has made it to the final link, then the result is more likely to be a variation in the degree of success (e.g. delivery of all levels of service etc.), rather than outright

failure. This is likely due to the fact that to make it to this final stage the PBC project would have received high level support within the agency for several (3 or more) years, the understanding of asset management would be reasonably well advanced, and other necessary enablers for PBC to occur would have been put in place (e.g. training, risk management etc.).

What is important to recognize is that even where the PBC never makes it into the delivery phase (i.e. no PBC Contractor is engaged) there are still significant benefits to be had from moving through the process. As illustrated within Figure 31, most of the institutional benefits associated with understanding basic asset management tenets such as whole-of-life costing, risk allocation, collection and analysis of asset data to gain a better understanding of the scope of the work required (inventory, condition, traffic etc.) etc., can be gained before the contract is actually let. Similarly the debate needed to set levels of service within a PBC are equally applicable to the wider road network and enable for a logical and rational approach to funding allocation across the total network. However, most of the user benefits are gained through the actual implementation of the PBC – with much of this often associated with the securing of an appropriate funding stream to enable the levels of service to be delivered.

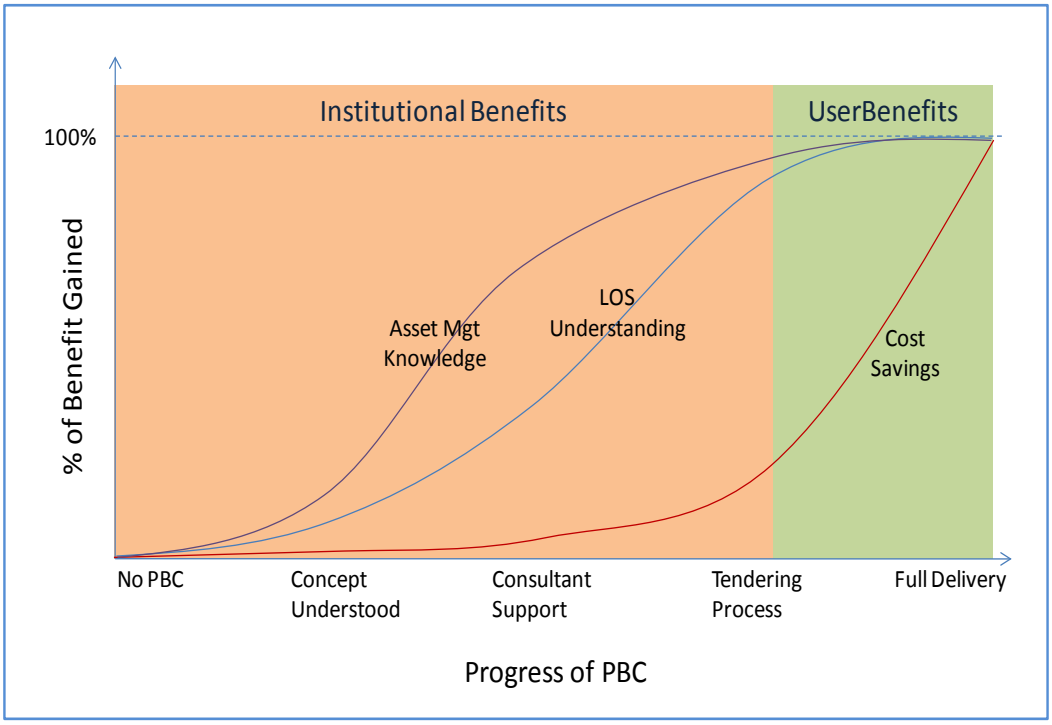


FIGURE 30: BENEFITS OF PBC THROUGH THE PBC IMPLEMENTATION CHAIN

While Figure 31 indicates a consistency of user benefits, the reality is that each road agency will be in a different financial position, and that while the indicators (such as roughness) may be consistent from one place to another, that the actual level of service set may vary significantly.

7.3 FINDINGS FROM TASK

7.3.1 Definition of Success

There is no consistent definition of success across the contracts reviewed. Some contracts have been successful in delivering the objectives, yet being deemed to have failed in other areas. For instance the Auckland Motorway Alliance project has delivered breakthrough performance on the measures put in place and delivered significant costs savings for the client, yet there is still a substantial work to be done to convince the wider industry of the merits of the approach.

It may well be more appropriate to consider success in terms of a PBC making it right through the implementation chain. In this case, there is a clear and consistent measure of success or failure – although there are significant benefits to be gained even when the final link in the chain is not completed.

7.3.2 Poland and Egypt

Neither Poland nor Egypt has made any significant progress towards implementing PBCs despite active encouragement to do so from the Bank. Based on the feedback received, the reasons for this are as follows:

- **Poland:** In recent times the Polish economy has received significant loans (Euro19B between 2005-2010) from the European Investment Bank for investment in new infrastructure, with loans for the period 2007-2013 expected to be in the region of Euro20B. With these loans comes a requirement for the borrowing country to partially match the loan with its own funding. The loan itself is very much focused on the building of new infrastructure – rail, motorways etc. at the national level to enable for Poland to better link and integrate with the European Union. These funding factors mean that the maintenance and rehabilitation of existing road infrastructure is not a high priority at present, with maintenance funds being below half what they were prior to the loans to enable Poland to provide its portion of funding to access the loans.

  Additionally, some at a national level are skeptical about the need to move to PBC following visits to Scandinavian countries and England, where perceptions are that the network is being managed fine without a full implementation of PBC[11]. Also, where initial funding is

[11] While the Highways Agency (England) MAC model has many aspects of a PBC, the lack of a clear linkage between performance delivered and payment received, means that the MAC model does not meet the definition of a PBC used within this report. Additionally the control over the renewal/rehabilitation works programme is retained in-house by the Highways Agency, restricting` the range of responsibilities of the contractor. However the concept of outsourcing, with the contractor delivering reactive maintenance and operational activities is consistent with the PBC methodology.

needed to bring the network up to standard, there is a view that the private sector financing costs will be greater than the borrowing power of the government, and therefore it would cost more to go to PBC.

That being said, there are pockets of regional interest in PBCs, with one contract 5year contract currently in place following upgrade of a 28km length of network.

Overall, the view is that Poland has not moved to PBC as they:

- Have significant financial pressures to reduce maintenance funding at present;
- Have not being convinced of the need at all levels of the road administration; and
- Do not see maintenance/renewal as a current priority in comparison with the building of new infrastructure.

While there is room to educate with respect to the latter two items above that are largely precluding the implementation of PBCs, the first item is a significant constraint at present. There appears to be an acceptance that higher maintenance/resurfacing/rehabilitation costs will be incurred in the future as a result of deferred works, but that the priority is currently on building new infrastructure.

- **Egypt:** The first PBC implementation in Egypt commenced in 2008 but was subsequently cancelled owing to a lack of competition (a single bid) and high costs (three times the estimated cost). The situation was summarized in a World Bank Working Paper[12] (full copy included in Appendix D) as:

  "The PPIAF has provided two grants to support the General Authority for Roads, Bridges and Land Transport (GARBLT) in Egypt in developing capacity to prepare and implement a performance based contract for road maintenance. The first grant (2005) financed the assessment by an international consultant of the viability of PBC for Egypt, developed a Framework for implementation, and provided staff training for GARBLT, contractors and consultants. This grant was fully utilized and a Framework Document for PBC for Egypt was the main output besides the draft tender document and PBC training presentations. Based on this, GARBLT included funding in its road maintenance budget for a 100 km long pilot project to try out PBC in Egypt.

[12] Performance-based Contracting of Maintenance of Paved Roads, Lessons Learnt from a Test Case in Egypt (Working Paper). Draft May 2009.

The second grant in 2007 provided support for a consultant to assist in tendering, provide training in evaluation and support implementation of the pilot besides much needed additional training for staff of GARBLT, contractors and consultants. Tenders were invited from 10 prequalified contractors, both public corporations and private entrepreneurs. Of the 10 firms, only five actually purchased the tender documents and only one firm (a public corporation, The Arab Contractors) submitted a bid. The bid was technically acceptable, but the bid price was close to three times the estimated cost. As a result the tender was rejected, and the planned implementation support by the consultant to help GARBLT in supervising the pilot project was cancelled."

The lessons learnt were summarized as follows (wording below is selected from the aforementioned working paper):

(a) *PBC Pilot projects by their very nature will inevitably have shortcomings that are associated with size, duration, coverage and risks that consequently require expectations not to be set too high in terms of costs, quality of service, and response time.*

(b) *Before pilot projects are undertaken, a sector review would be helpful in identifying areas of particular risks and help in taking account of international PBC experience. Drafting a Framework for introduction of performance based road maintenance contracts is essential.*

(c) *PPIAF (Public-Private Infrastructure Advisory Facility) grants are very helpful in providing funding for developing a framework, capacity building and country specific PBC tender documents. In cases with high uncertainty about the condition and performance of pavements of pilot PBC project, detailed condition surveys should be provided for tendering purposes. This may require other funding sources for implementation of a pilot due to costs associated with such surveys.*

(d) *In cases where upfront detailed survey work cannot be done to determine extent of needed rehabilitation, one could consider allowing the contract to include detailed testing of the pavement during an early stage of implementation, to be carried out by the contractor but with participation by the road agency. Required deep repairs and rehabilitation sections should jointly be agreed upon and paid for under (for example) a significant contingency item in the contract using rates for emergency works. The rehabilitation design could also be done by the contractor using rates provided in the contract. This*

can be simplified by carrying out engineering design of the rehab works prior to the bidding.

(e) A country specific PBC tender document for a pilot project following the Bank's sample or standard bidding document can be quite complex even in English language. Much care should be taken to have such documents professionally translated to avoid word for word translation that may be difficult to interpret when preparing bids (or in case of disputes during implementation).

(f) Cost estimates of pilot projects would have to be updated close to bid opening in case of rapid inflation, and include adequate allowance for contractors' risks that will be reflected in the rates. Price adjustment clauses in the contract need to cover all key inputs including labor, and cover all payments not just rate-based items in the Bill of Quantities. Finally, one cannot just apply rates from historical construction contracts, but allow for the market to set the costs of maintaining the current road network.

(g) The reputation of the road agency in contract management and its discipline in making timely payments is also a factor that affects costs and contractors' willingness to prepare bids for maintenance projects. Saturating the construction market with new construction of roads (some with questionable rates of returns), while a huge backlog of maintenance and rehabilitation works remains unaddressed is a self-defeating expenditure policy that not only Egypt is suffering from.

(h) A Road Maintenance Manual describing all road maintenance activities is essential even for a pilot maintenance contract. It would provide guidance for contractors as well as in-house providers of maintenance services and would set standards, specifications and operational procedures for maintenance works on both paved and unpaved roads.

(i) Capacity building before piloting PBC of road maintenance cannot be over-emphasized. But without practical on-the-job training in an implementation of the pilot, much of the theoretical learning will be lost after some time. It is therefore essential that training of road agencies, contractors and consultants is followed up with hands on experience through tendering, award and implementation.

(j) A good road inventory and upfront pavement condition surveys could help in reducing risks and cost of the pilot contract. Consideration should be given to include this as a deliverable by the contractor in

addition to the design of critical repair and rehabilitation works in the early stage of the pilot contract.

(k) Incorporate procurement, supply and installation of axle load control equipment in a new pilot PBC contract. Even allowing the contractor's staff to operate and manage the controls could be considered, while leaving the instructions to offload and issuance of penalty citations to the enforcement authority.

(l) Simplify the OPRC sample bidding document, or adapting the WB Standard Bidding document, and have a specific bidding document issued for maintenance of paved roads. Special considerations should be given to introduce clauses and specifications aimed at reducing risks in pilot projects, and to identify conditions under which PBC is inappropriate. Carry out professional translation of the bidding documents into key languages not leaving it entirely to piloting road administrations.

All the above are consistent with our findings on PBCs, with the following specific comments:

- The proposed solution under item (d) above would, in our opinion, be better addressed by undertaking further testing in advance of the bid period, and/or having the contractor bid output rates for various quantum of work – which could then be used as the basis for agreeing any variation;

- Item (l) is potentially very dangerous and will potentially result in the contractor signing a different version of the contract to that bid upon. Managing multiple language versions of the document will also become administratively intensive. However the advice of not leaving translation to the piloting road administrations is supported.

7.3.3 Critical Success Factors

The following are identified as critical success factors for PBC, without which the chances of their being a successful outcome are significantly reduced.

1. Institutional Buy-in: There has to be a genuine institutional desire and belief that PBC procurement options will offer significant achievements of given objectives for an agency. This buy-in should also be linked to specific individuals in an organization who will be prepared to champion the PBC process.

2. Financial: Two aspects were identified with regard to the financial aspect of a successful PBC, with these being:

a. Surety of Funding: Where there is not clarity on the long-term availability of funding to support the contract (e.g. if World Bank loans don't cover the entire PBC contract period), then the contracting industry will be concerned as to the prospect of being paid and may seek to "load" his bid to endeavor to recover as much of his costs as possible during the term of the loan.

b. Financing Costs: If the wrong payment model is included into the PBC, the contracting entity will potentially be asked to carry significant financing costs. In the case of the early Argentinean PBC, this lead to bids being significantly above estimates and ultimate lead to the development of an alternative PBC contract/funding model (CREMA) to ensure the affordability of the contract and that the funds were being invested into the maintenance of the road and not just on paying interest on bank loans.

3. Legal: The legal issues tend to be more of an enabler than an identifier of likely PBC success or failure. If the legal framework is not conducive to a PBC then either it will not be possible to implement at all, or the risk pricing will potentially be very high (making the PBC financially unattractive).

4. Institutional Knowledge in both the Transport Agencies and the Lending Institutions: While some shortcomings in institutional knowledge can be addressed via the use of consulting advisors, it is essential that the basics of the PBC workings are soundly understood.

5. Bidding Process: Successful implementation of PBC (especially in the early years of implementation of PBC into a country/organization) requires for the selection of a contractor with the right skill mix to deliver the project. If selected on a lowest price basis, there is a reduced chance of selecting a competent contractor who fully understands the principles and risks of a PBC. To mitigate this, one of two approaches are recommended:

a. Include a significant non-price weighting into the contractor selection process, or

b. Implement a two-stage bidding process, where stage one short-lists only those contractors that have a clearly demonstrated competency to do the work.

Either of these approaches should be considered alongside industry engagement to both gain knowledge on the perceptions of risk within industry, and also to ensure a correct understanding of expectations is made.

6. Performance Measurement: Both the ability to measure performance and clear consequence of non-conformance are essential to PBC success. Management regimes that use a predominance of response time measures tend to be more cumbersome to enforce when compared to the "density of defect" type measures and this latter (frequency/density) approach should be encouraged (refer example below). Similarly the consequence of non-conformance needs to be graduated and equitable with the level of non-conformance. The traditional approach of "three strikes and you are out" has not worked to drive performance and should be discouraged from use. Approaches such as the "bucket of defects" (Opus (2009)) have been found to be simple to work and provide the contractor with an incentive to perform over the duration of the contract. Measures need to focus on the short, medium and long term needs of the asset to ensure a balance of focus is maintained. Additionally there is the need for clear business improvement measures to encourage innovation and optimize the chance of progressing asset management practice through the course of the contract.

Example of Time Bound versus Frequency Measures

Considering potholes a time bound performance measure would be of the format

- Time from identification to repair if diameter 100-300mm in diameter 7days
- Time from identification to repair if diameter >300mm in diameter 1 day

Converting to a frequency based performance measure, potholes would be controlled by the following format:

- Number of potholes per km with diameter 100-300mm 2
- Number of potholes per km with diameter >300mm 0

In both scenarios, both the presence of smaller potholes is controlled and the presence of large potholes is effectively eliminated. The difference with the frequency approach is that it can be enforced by a single drive through of the road, without having to consider how long the pothole had been in existence for. This not only makes for easier monitoring by the road agency and monitoring consultant, but also makes the measures more "auditable" by the general road user.,

7. Risk Sharing: The allocation of risk was not observed to be a major identifier of success or failure of a PBC so long as risks were clearly apportioned and the contracting party was sufficiently experienced to manage (and price) the risk. Typically "inappropriate" risk allocation (transferring too much risk to the PBC contractor) tended to result in higher bid prices that would otherwise have resulted. That being said, if the occurrence of a risk would render the contract financially unviable (i.e. the risk would remove all profit from the contract), then there is an increased chance of default on the part of the contractor – a scenario under which neither party wins. Another element of inappropriate risk transfer that had a detrimental effect on the MRWA contracts (refer to Appendix C) was that transfer of an excessive level of

risk/responsibility onto the contractor also meant that you were transferring the authority to make asset management decisions about the network. The MRWA client was not comfortable with this level of transfer of authority, or more plainly put were unhappy with their "loss of control of their asset", something that was a prime area they addressed in their next generation of contracts (ISAs). Additionally the quantum of risk being carried by the contractor is closely aligned to the contract model as identified in Section 3.3.10.

8. Timing: As noted in Section 7.2, the process to implement a PBC in an agency which does not have experience will typically be 3-5 years. This is a relatively long time to maintain momentum for an initiative, especially if considered against the duration of many international funding loans. There would appear to be some anecdotal evidence that compressing the timeframe would help build enthusiasm and enable a greater portion of PBCs to make it to the Delivery phase. The development of a full suite of standard Bank bidding documents, better support material and approval processes could significantly reduce the time to get from conception to implementation.

9. Sufficient technical support during implementations of PBCs. For example there are some examples of PBC implementations in Africa where neither the client, nor the contractors had prior experience of PBCs. In such cases including a 3rd party consultant for assisting during the bidding and initial stage of the contract is essential.

10. 'Control' underpricing of bids through a mechanism to disqualify unsustainable low bid prices. No contractor can be successful on a contract without receiving sufficient compensation for work being undertaken.

11. Control the minimum level of improvement work required to maintain Levels of Service in the long-term. Underpinned quantities, with an associated robust quality control program, can be used to ensure that no consumption of the network takes place during the contract term. Technical measures such as FDW data can have a high degree of variability with certain pavement/geology/weather combinations and need to be supported by other methods.

8 TASK 6: DEVELOPING A WORK PROGRAM FOR PHASE 2

8.1 BACKGROUND TO TASK

During the project initiation phase, an expectation on the focus and magnitude of work for Phase 2 was developed. The concept was based around an expectation that most projects reviewed would have progressed well into the implementation phase, and that the improvements needed to existing material would be around making the projects even more successful in the future.

At the time of the project inception, the tasks envisaged for Phase 2 were:

- *Task 7: Developing a report to guide future engagement in PBC projects and a Transport note summarizing key messages of the report;*
- *Task 8: Producing a WB Strategy on contracting and Policy of PBCs;*
- *Task 9: Review and making proposals of the training materials and knowledge management; and*
- *Task x: Disseminating the outputs of the first and second phase.*

As has been found during this phase of the project, many of the issues (failures) of PBC occur much earlier in the PBC Implementation Chain (refer to Figure 30). This suggests that while there may be gains to be had from improving the sample contract documentation, it is supporting the entire implementation chain that will yield the greatest benefits.

8.2 PROPOSED PHASE 2 WORK PROGRAM

Section 7.2 presented the seven links in the PBC Implementation Chain, including a view on how failure might occur at each stage and what might be ways to mitigate these failures. Based on the Implementation Chain and the findings of this review, our proposed Phase 2 work program is presented in Table 10.

In reference to the tasks noted above that were included in the inception report, both task 7 and 9 are included directly in the table below. Task 8 is also included, but given the need to provide increased support across the Implementation Chain,

the scope becomes broader and necessarily involves greater Bank involvement that originally planned.

Our work program is based around a strong belief that the future direction for the Bank support on OPRCs should be around:

- Firstly, supporting the development of good asset management practices to produce and asset management plan with incorporated risk allocation, levels of service, forward works program etc.; and
- Secondly, supporting OPRCs as a means of driving the paradigm shift necessary to deliver the asset management outcomes over the long term, but yet recognizing that procurement of the physical works by OPRC is one of many options available.

TABLE 10: PHASE 2 WORK PROGRAM

Note: Items in italics are outside of scope as outlined in the Inception Report

Link in Implementation Chain	Proposed Work for Phase 2	Proposed Work Post Phase 2
A. Concept	Develop better Bank guidance on the benefits of an asset management approach and a full suite of PBC methods available, including a clear selection criteria for each model type and some factually based analyses of the value delivered by the PBC model. This would involve expansion of the decision tree (Figure 32) for selecting contract model types and for progressing through the Implementation Chain. This would be in the form of a guide, transport note and a Bank strategy on PBCs (promotion of AM, different contract types, etc.). [Note: This equates to Tasks 7 & 8 of the Inception Report] *Refinement of the Bank Resource Guide, with the referencing of the materials to each of the model forms and the link in the Implementation Chain that they pertain to.* Review of the existing training materials and development of proposal to amend/update/expand. [Note: This is Task 9 of the Inception Report]	

B. Move from Concept to Consultant Support		*Develop a sample Terms of Reference for the consultant support to suit the case at hand.* *The TOR should require for the delivery of a draft Asset Management Plan that would provide a benchmark cost comparison for whatever form of PBC was subsequently decided upon.*
C. Consultant Support		*Provide asset management plan template for completion by the Consultant as a first deliverable.*
D. Progression to the Bidding Process		*Develop templates for determining the financial model leading to a payment model.* *Develop a sample risk allocation table.*
E. Bidding Process		*Develop a suite of sample OPRC contract specifications for each of the contract types (Network Management and Unpaved Roads).*
F. Signing of the PBC Contract		*Develop a sample terms of reference for the engagement of a monitoring consultant to support the contract once implemented.* *Important element for a success is to select Monitoring Consultant, who will be instrumental to (i) ensure that the contract is implemented according to the contract requirements, detailed designs prepared in accordance to the specifications, (ii) check and (iii) confirm the payment requests if meeting the criteria of levels of services or need a revision. It's important to have a clear guidance on their selection, besides having a typical sample TOR.*

8.3 PBC DECISION TRADE

Figure 32 provides a basic overview of the decisions and processes that need to be made to support the PBC Implementation Chain. As part of Phase 2 it is proposed to enhance the figure to show linkages to the various support materials and sample bidding documents etc., as well as the outputs from the various stages (asset management plan, forward works program etc.).

A key decision to be made early on is that of whether there is sufficient institutional support for a PBC. If this is not currently present, or cannot be readily gained, then the chances of progressing through the full implementation chain are very remote.

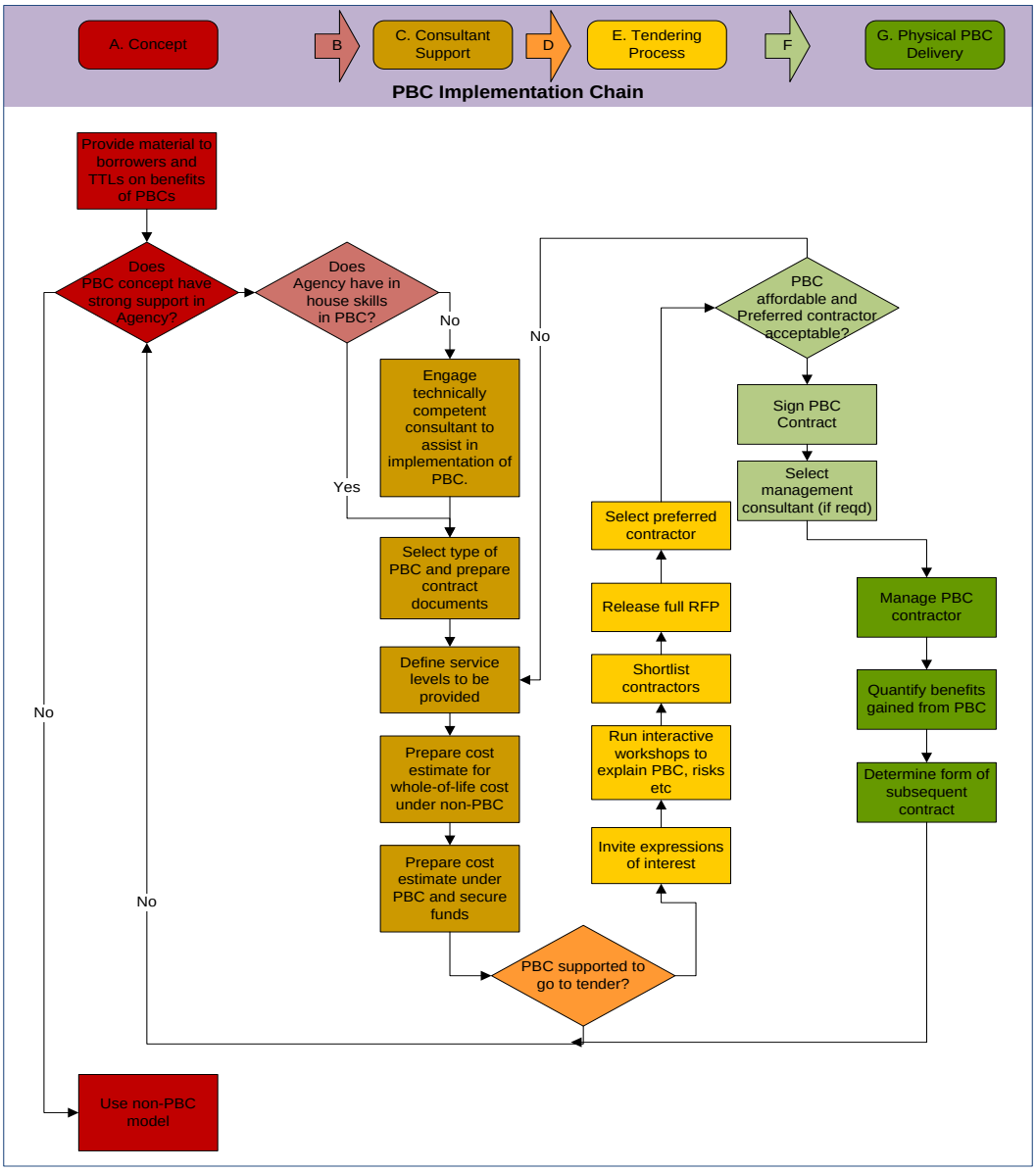


FIGURE 31: PBC SELECTION FLOW CHART

9 CONCLUSIONS

Following a review of a variety of PBC contracts (both implemented and those that have not made it to the implementation phase) from around the world, our team have reached the following conclusions:

Bringing together the findings from Tasks 1-6, the study team has concluded that:

1. There are four primary scenarios under which PBCs are used for road networks:

    a. Generally a poor condition – typically a Design Build Maintain Operate Transfer (DBMOT) model form;

    b. Generally good condition – a network management contract;

    c. Unpaved roads – a variation of either of the above but with specific variations to address the different performance and life cycles; and

    d. Networks needing significant investment in improvements and additional funding from the private sector - Public-Private-Partnerships, Toll roads and the like.

2. Many of the benefits of implementing a PBC are directly aligned to the benefits associated with good asset management, and it may be better to position PBC as a facilitator of good asset management, rather than a goal in its own right;

3. A sound understanding of risk, the allocation of risk and the definition of risk boundaries is essential to both asset management and the identification of the benefits of one contract model over another.

4. Very few PBCs fail once implemented (although not all deliver the full benefits initially realized). Most "failures" of PBC are actually situations where the implementation did not occur at all. Even where implementation did not occur, there are potentially significant benefits to be gained from the prior steps – such as the definition of levels of service, understanding of the necessary funding levels to deliver least whole-of-life cost solutions etc.;

5. To make it through the full PBC process, the project requires strong champions in the road agency, the ministry of finance and the Bank (or other lending institution);

6. The term OPRC has a confused usage within the Bank and industry, with it both being a specific contract form (aka aligns to the sample OPRC bidding

documents) but is also used as an overarching "umbrella" term to describe PBCs within the road sector.

7. The existing sample OPRC bidding documents seldom get used without substantial change to accommodate the four situations noted above. This then results in an extension of the time required for the procurement process, often with an associated loss of interest from all parties – increasing the chance of the PBC not progressing to implementation;

8. Procurement of PBC – both for consultant support and the physical works – on a lowest price basis is not in the best interest of the PBC in any country where PBC (and asset management) experience is not well developed. The chances of successfully making it to the implementation stage (and with the correct PBC model in place) is greatly enhanced where experienced support is engaged;

9. Road Authorities often struggle to recognize the value-for-money (FM) PBCs [and good Asset Management] have to offer. This is understood to be primarily as a result of the PBC often addressing issues of under-investment, poor quality workmanship, risk management, varying levels of service etc., which can make the PBC appear expensive when compared to the historic method of maintaining the network. There is a need for better guidance on how to determine the FM argument for the PBC.

10. PBCs offer a procurement model that is more resistant to corruption than traditional input/output contracting. This is for two primary reasons:

    a. There are fewer transactions involved, such that auditing is much easier;

    b. The levels of service can be made public and defined in such a way that the motoring public is able to identify if contractual compliance is being met.

11. The retention of asset value is a key challenge. Reliance solely on FWD results is not considered prudent as variability in test results can be significant. The use of underpinned quantities of work, with an associated quality control regime, to ensure the asset load carrying capacity is managed appropriately is a widely used best practice to support the FWD testing/analysis regime.

12. The project has identified the concept of a PBC Implementation Chain that identifies the seven steps that any PBC must traverse in order to make it to the "implemented" stage. This is an important aspect to understand, as success (and failure) can occur at any link in the chain. It is also important to understand that some benefits can be gained at each link in the chain, and that even when the final implementation stage is not reached, that a great number of benefits can be realized for both the network under investigation, and the wider network managed by the road agency.

The project has identified the concept of a PBC Implementation Chain, as per Figure 30 and repeated below. This is an important aspect to understand, as success (and failure) can occur at any link in the chain. For Phase 2 of this project, work activities have been focused on both improving the outcomes of those projects that make it to Link G, and also to getting a greater portion of the projects from A to G. The Phase 2 work plan is presented in Table 11. The improvement plan is based on a desire to improve asset management within the road agency, with the OPRC being proven way of driving the paradigm shift necessary in both the agency and the supply chain.

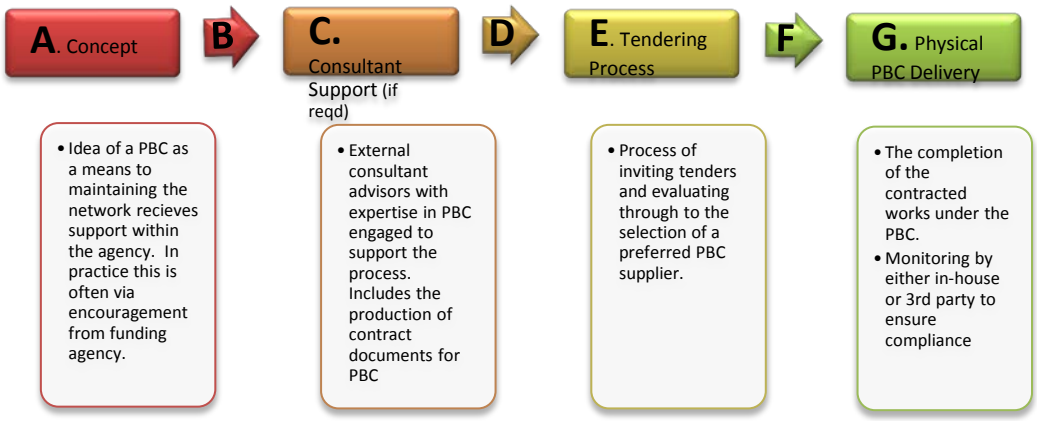


FIGURE 32: PBC IMPLEMENTATION CHAIN (REPEAT OF FIGURE 30)

TABLE 11: PHASE 2 WORK PROGRAM (REPEAT OF TABLE 10)

Link in Implementation Chain	Proposed Work for Phase 2	Proposed Work Post Phase 2
Concept	Develop better Bank guidance on the benefits of an asset management approach and a full suite of PBC methods available, including a clear selection criteria for each model type and some factually based analyses of the value delivered by the PBC model. This would involve expansion of the decision tree (Figure 32) for selecting contract model types and for progressing through the Implementation Chain. This	

	would be in the form of a guide, transport note and a Bank strategy on PBCs (promotion of AM, different contract types, etc.). [Note: This equates to Tasks 7 & 8 of the Inception Report] Refinement of the Bank Resource Guide, with the referencing of the materials to each of the model forms and the link in the Implementation Chain that they pertain to. Review of the existing training materials and development of proposal to amend/update/expand. [Note: This is Task 9 of the Inception Report]	
Move from Concept to Consultant Support		Develop a sample Terms of Reference for the consultant support to suit the case at hand. The TOR should require for the delivery of a draft Asset Management Plan that would provide a benchmark cost comparison for whatever form of PBC was subsequently decided upon.
Consultant Support		Provide asset management plan template for completion by the Consultant as a first deliverable.
Progression to the Bidding Process		Develop templates for determining the financial model leading to a payment model. Develop a sample risk allocation table.
Bidding Process		Develop a suite of sample OPRC contract specifications for each of the contract types (Network Management and Unpaved Roads).
Signing of the PBC Contract		Develop a sample terms of reference for the engagement of a consultant to support the contract once implemented.

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APPENDICES

12.1 APPENDIX A: PROJECTS REVIEWED

The projects in italics were contacted, but no specific project response was obtained from the TTLs.

No	Region	Country area	Project name	Project ID	Status	TTL
1	LAC	Argentina	RD Maintenance & Rehabilitation Section	P006003	Closed	Gerard L. Liautaud
2	LAC	Argentina	National Highway Rehabilitation and Maintenance	P052590	Closed	Juan Gaviria
3	LAC	Argentina	National Highway Asset Management	P088153	Closed	Silva, Maria Marcela
4	LAC	Argentina	Provicial Road Infrastructure Project	P070628	Active	Silva, Maria Marcela
7	LAC	Argentina	APL2 National Highway Asset Mgt	P095569	Active	Maria Marcela Silva
8	LAC	Brazil	RGS (Rio Grande do Sul) Highway Management	P034578	Closed	Eric R. Laucelot
9	LAC	Brazil	Federal Highway Decentralization	P006532	Closed	Aymeric-Albin Meyer
10	LAC	Brazil	Road Transport Project	P092990	Active	Eric R. Laucelot
13	LAC	Paraguay	Road Maintenance	P082026	Active	Andres G. Pizarro
15	LAC	Uruguay	Uruguay Transport Infrastructure Maintenance and Rural Access	P057481	Active	Andres G. Pizarro
17	AFC	Botswana	Integrated Transport	P102368	Active	Supee Teravaninthorn
18	AFC	Chad	National Transport Program Support Project	P035672	Closed	Kingson Khan Apara
19	AFC	Chad	Transport Transit Facilitation	P079736	Active	Jean-Francois Marteau
20	AFC	Nigeria	Rural Access and Mobility Project	P072644	Active	Justin Runji
22	AFC	Tanzania	Central Transport Corridor Project	P078387	Closed	Dieter E. Schelling
23	AFC	Liberia	LR-Urban and Rural Infrastructure Rehabilitation	P113099	Active	Emmanuel A. James
24	AFC	Zambia	Agricultural Development Support Program**	P070063	Active	Indira Janaki Ekanayake
25	*SAR*	*India*	*Uttar Pradesh State Boards Project*	*P067606*	*Closed*	*Tawia Addo-Ashong*
26	*SAR*	*India*	*Tamil Nadu Road Sector Project*	*P050649*	*Active*	*Pratap Tvgssshrk*
27	*SAR*	*India*	*Rural Roads Project*	*P077977*	*Active*	*Ashok Kumar*
28	SAR	India	Punjab State Road Project	P090585	Active	Benedictus Eijbergen
	SAR	*India*	*Andhra Pradesh Road Development Corporation Anclhia Padesl Performance Based Contract*		*Active*	*Kulwinder*
31	*MNA*	*Yemen*	*Second Rural Access Project*	*P085231*	*Active*	*Jean-Charles Crochet*
32	ECA	Albania	Transport Project	P078949	Active	Richard Martin Humphreys
33	ECA	Bosnia and Herzegovina	Road Infrastructure and Safety Project	P100792	Active	Maria Carolina Monsalve

34	*ECA*	*Bulgaria*	*Road Infrastructure Rehabilitation Project*	*P099894*	*Active*	*Mohammed Dalil Essakali*
38	*ECA*	*Romania*	*Transport Sector Support Project*	*P093812*	*Closed*	*Mohammed Dalil Essakali*
39	*ECA*	*Serbia & Montenegro*	*Transport Rehabilitation Project*	*P075207*	*Active*	*Richard Martin Humphreys*
40	EAP	Philippines	First National Roads Improvement Project	P039019	Closed	Benedictus Eijbergen
42	EAP	Philippines	National Roads Improvement and Management (APL) Phase 2	P079935	Active	Siele Silue
Unsuccessful PBC projects						
2	MNA	Egypt		P100276	Cancel of PBC	Michel Bellier
3	ECA	Poland	Road Maintenance & Rehabilitation 2 Project	P088824	Cancel of PBC	Radoslaw Czapski
4	ECA	Poland	Road Maintenance & Rehabilitation 3 Project	P096214	Cancel of PBC	Radoslaw Czapski
5	EAP	Thailand	Highways Management Project	P075173	Cancel of PBC	Zhi Liu
6	EAP	Indonesia	Strategic Roads Infrastructure Project	P079906	Cancel of PBC	Mitsuyoshi Asada
Other Projects that Opus et al Have Proposed						
1		Australia	NSW RTA PSMC		Active	RTA David Paine or Mike Veysey
2		Australia	WA PSMC		Closed	Robert Barnesley (MRWA)
3		Australia	WA ISA		Active	Robert Barnesley (MRWA)
4		Australia	Melbourne PPP (Connect East)		Active	Ian Mullett
5		New Zealand	WBOPDC PBC01		Active	
6		New Zealand	Northland PSMC		Closed	
7		New Zealand	Waikato PSMC 001 SH3		Active	
8		New Zealand	Auckland Motorway Alliance		Active	
9		*United Kingdom*	*Highways Agency MACs*		*Active*	
11		*Canada*	*British Columbia Maintenance Contracts*			
12		Malaysia	PPP		Active	PLUS Contact (from TP)

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		Montenegro				*Humphreys*
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5		New Zealand	WBOPDC PBC01		Active	
6		New Zealand	Northland PSMC		Closed	
7		New Zealand	Waikato PSMC 001 SH3		Active	
8		New Zealand	Auckland Motorway Alliance		Active	
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11		*Canada*	*British Columbia Maintenance Contracts*			
12		Malaysia	PPP		Active	PLUS Contact (from TP)

12.2 APPENDIX B: QUESTIONNAIRE TEMPLATE

(i) Question items which the OPUS and WB fill in before interviewing
(ii) Question items which the TTL is expected to manually complete before interviewing.
(iii) Question items which the OPUS project team directly interview TTLs and would fill in then.

0	**Survey Setup**	**Response**	Commentary on Nature of Response Sought
0.1	**Date**		format of 01-Jan-2011
0.2	**Project Name**		
0.3	**Project ID**		refer project spreadsheet for unique ID
0.4	**Interviewer's Name**		

1	**Background**	**Response**	Commentary on Nature of Response Sought
1.1	Country		
1.2	Road Authorities Name		
1.3	Location of Contract Area		Description of the geographical location of the network e.g. Southern Punjab.
1.4	Interviewee		
1.5	Interviewee's Organization		
1.6	Interviewee's Position Title		
1.7	Interviewee's Contact details; Postal Address		

b	Email		
c	Phone Number		
1.8	Interviewee's Organization Type	Select...	Select from drop down list of Funder, Road Authority, Consultant, Contractor, or "other"
b	if other…		Provide text if response above is "other"
1.9	Supplementary interviewee's Name and Contact Details		If there are any other contact people who it is appropriate for interviewing about this project, please provide name and contact details (organization, email and phone).
1.10	Total center line length of roadway managed by road authority which is in charge of PBC in km		e.g. 24,000km
1.11	How many PBC projects does the road authority currently have operational?		Total number of PBC projects currently in operation
b	How many PBC projects does the road authority currently have under consideration/implementation?		Total number of PBC projects currently in development
1.12	What proportion of their network is managed under PBCs?	Select...	Select from the drop down list the approximate percentage of the network being managed under PBCs (<1%, 1-5%, 5-10%, 10-25%, 25-50%, 50-75%, 75-99%, 100%)
1.13	Were the principles of Asset management understood and practiced before the advent of this PBC?	Select...	e.g. were concepts around levels of service, risk allocation/mgt, data, and whole of life costing all understood prior to the PBC implementation. Pick answer from the list (very little, limited, moderate, general, fully).
1.14	Are they more widely practiced now?	Select...	Has the implementation of the PBC improved overall Road Authority understanding & practice of asset management (yes/no/not applicable)
1.15	How did the countries legal/financial framework impact the scope /duration of the contract?		Did the duration of the PBC mean that special legislation was needed to overcome legal or financial hurdles, and/or was the form of PBC

			altered to fit within the existing legal/financial constraints
1.16	Are concerns about the long term stability of the government thought to have impacted on the success of the contract, number of tenderers, term of the contract, perceived risks or price?	Select...	Select from None, Very Few, Some, Moderate, High Impacts(change in govt. could have a significant impact on PBC)
1.17	Were any measures implemented to mitigate the impact of possible future changes in government philosophy?		Please describe (e.g. term of the contract, payment profile, bonds etc.).
1.18	General Comments on any of the responses above (including clarifications of responses given)		

2.0	Network Details of the PBC projects		
2.1	Nature of the network. The connectivity of the network of roads impacts on the efficiency of the contractors operations. When examined on a map, which of the options best describes the network of roads within the contract?	Select...	Linear = Primarily one long road Herring boned = A main spinal road with multiple "dead end" side roads Networked = Compact well connected routes Disjointed - network made up of various sub-networks some distance apart
2.2	Overall condition of network prior to commencement	Select...	Based on local perception, pick from list (Very poor, poor, fair, good, and excellent).
2.3	Typical Average Daily Traffic (vehicles per day) at start of contract		
a	....min	Select...	What is the typical minimum daily traffic on the network (pick from <100,100-500,500-1000,1000-10000,10000-20000,20000+)
b	....max	Select...	What is the typical maximum daily traffic on the network (pick from <100,100-500,500-1000,1000-10000,10000-20000,20000+)
2.4	Typical % of heavy vehicles at start of contract	Select...	Include large buses and trucks capable of carrying over 5tonne loads (picked from <5%, 5-10%, 10-

		16%, 17-25%, 25-50%, 50-75%, 75-100%)
2.5 Comment on changes to traffic since the start of the contract		Has the improved condition (if any) attracted more traffic than expected? If so this can cause accelerated deterioration and problems for the contract if risk not clearly defined. Please describe
2.6 length of network in contract [km]		What is the total centerline length of the network within the PBC in km
2.7 Are all roads in the area included?	Select...	All Road Authority roads = all roads within the geographic outline of the network are included in the network All Roads = all roads within the geographic outline of the network, irrespective of the road authority, are within the network No = Not all the Road Authorities roads within the geographic outline of the network are included in the network
2.8 Approximate Urban / rural split?	Select...	% urban. For the purposes of this response consider urban to represent the length where there is direct access from shops and houses etc. in a built-up environment. Select from <5%, <25%, <50%, <99%, 100%
2.9 Surface Types		% earth (non-all weather) roads
b		% gravel
c		% surface dressing / chip seal
d		% Asphalt/Bituminous Concrete surfacing on flexible (granular) base

e		% Asphalt/Bituminous Concrete on rigid base (either deep asphalt or concrete)
f		% Concrete surface
g		% Other
h		TOTAL FOR CHECKING - Should be 100%
2.10 Does Client have any input into Asset management decisions (i.e. how involved in the Forward Works Program is the client)?	Select...	e.g. does the client get to approve the annual works program, treatment decisions, etc. Select from list of None, Comments on FWP, Approves FWP, Helps develop FWP, Develops & Provides FWP
2.11 Was whole of life costing a feature of the decision making prior to this contract?	Select...	Prior to the PBC, were treatment decisions made on the basis of the "in-year" costs or were they made in consideration of costs over a longer period (say 10 years or more) (select from Yes, No)
2.12 Name of any external Asset Mgt Organization and their role (i.e. has the client contracted another organization to undertake any functions such as monitoring or auditing)?		Besides the PBC Contractor, has the client engaged any other parties to undertake part of the asset management activities? For instance is there a 3rd party audit contract in place to oversee performance.
2.13 How was routine maintenance (e.g. potholes, vegetation, and drainage cleaning) delivered prior to this contract?	Select...	Select from choice of In-House (force account), Outsourced (short term <=5yrs), Outsourced (long term >5years)
2.14 Were Service Levels defined before this contract? Comment on level of compliance and any changes introduced by new contract.		Prior to the PBC, were there defined service levels (e.g. 90% of the network to have an IRI<5m/km) or were these defined as part of the PBC. Has there been an issue of compliance as a result of the PBC?

2.15 General Comments on any of the responses above (including clarifications of responses given)		

3.0 Contract Details		
3.1 Contract Title		This is the same as the Project Title above and copies down
3.2 a. Local Generic Name		Some contracts have a less formal name that they are known by within the road authority / local industry e.g. "Contract 11111 for maintenance and renewal of 600km of roads in yyy" may be known locally as the "Northland PSMC"
b. General Description of Contract		In general terms, please describe the nature of the contract, what is included, and what are the performance based payment elements. e.g. "The project entails 600km of roads that are in generally poor condition. It involves widening 100km of roads, and rehabilitating the entire network in the first 5 years, then maintaining it all for a period of a further 5years."
3.3 PBC Contract descriptor	● Case A: The management of road networks that have pavements in a wide range of conditions from poor to good – [Asset Management focused]; ● Case B: The management of road networks which have fallen into disrepair and require extensive reconstruction of the pavements before they can provide a reasonable level of service. – [Renewals focused] ● Case C: The management of unpaved road networks only, - [Unpaved] ● Case D: The management of road networks under public-private partnerships – [PPP]. Typically these roads are tolled and often	

	have a significant amount of new asset to be constructed ● Case E: Other (Describe below)	
b If other		Please describe if response above is Other
3.4 What basic contract form was used	Select...	World Bank funded projects are often based on one of the following (select from the list): CREMA, PMMR, OPRC, OPBM/DPBM), LTPBMC or Other (please specify)
b If other		Please describe if response above is
3.5 Term of contract [years]		This is the base term of the contract in years
3.6 Value of contract [USD$M]		Value of the contract over the base term in US$ Millions
3.7 Are extensions/reductions in the term specified?	Select...	Select from "No, Extensions, Reductions, Both". This question is about whether the contract enables extensions/reductions in term, and not whether either was awarded to the contractor.
3.8 Basis of change to term?	Select...	What is the means by which the contract term may be varied: Subjective, Performance based, Financial based
3.9 How the project is principally funded?	Select...	Select from General taxes (including road user), Special taxes, World Bank funds, Other International Lending institution, Other

		financing (describe below)
b If other		If other selected above
3.10 What proportion of the contract value is funded by World Bank funds?	Select...	Select from 0%, <25%,25-50%, 50-75%,75-99%, 100%
b If funded by lending institution (e.g. World Bank), does the term of the funds match the term of the contract? If not, describe where the funding surety after the lending period is coming from.		It is possible that the PBC may run for 10years, yet the duration of any funds to establish the PBC may only cover the first 3-5years.
3.11 Did the availability of funding impact on the term of the contract?	Select...	Select from Yes, No
3.12 Bidding evaluation methodology	Select...	Lowest price Conforming? Quality /price based? Quality only? Other [describe]
b If other		Describe if other selected above
3.13 Length of Bidding Period (months)		What is the time between when the tender documents are released to the contractors, and when tenders close
3.14 Number of tenders received		
3.15 Range of tender prices		Provide in US$ e.g. $35-70M
3.16 What was the Engineer's estimate for the contract in US$M?		e.g. 50 if unknown use 0
3.17 Outline the contract governance structure. Is the Client managing the contract itself? Is a monitoring consultant involved? Discuss		

3.18	Payment structure.		Is the payment uniform over the duration of the contract? Is there higher payment in the early part of the contract to bring the network up to standard? Etc.
3.19	While PBC contracts generally have a domination of payment on a lump sum basis for the delivery of a required performance Outcome (e.g. roughness < 4IRI) it is common to have some aspects paid for under either an Input (e.g. $/hr of labor) or Output (e.g. $/m2 of rehabilitation) basis.		
a	What works are paid for on an Input [bill of quantities] basis?		e.g. storm damage, emergency repairs ($/hr, $/m3 of materials etc.)
b	What works are paid for on an Output [unit rate] basis?		e.g. pavement rehabilitation ($/m2), road widening schemes ($/km)
3.20	Is there a penalty regime for lack of performance	Select...	If the contractor does not meet the required performance standards, is there a reduction in payment and or some other penalty regime. Describe below if Yes
b	Describe if yes		
3.21	Name of Contractor		If a consortia, then list main participants
3.22	Local Company or Foreign?	Select...	Pick from Local / Foreign
3.23	Asset Management Advisory Services provided to contracting entity by?	Select...	Select from In-House, Consultant employed by Contractor, Independent Consultant, Client Organization
3.24	General Comments on any of the responses above (including clarifications of responses given)		

4.0	Scope of Services		
4.1	Routine Maintenance (tick for yes)	☐	Road pavements
b		☐	Pedestrian pavements
c		☐	Surface drainage
d		☐	Underground drainage
e		☐	Bridges
f		☐	Culverts
g		☐	Retaining walls
h		☐	Delineation
i		☐	Signs - non regulatory
j		☐	Signs - regulatory
k		☐	Barriers
l		☐	Signals
m		☐	Technology and ITS solutions
n		☐	Lighting

o	☐	Street cleaning
p	☐	Litter pick up
q	☐	Traffic management (beyond own works)
r	☐	Incident response
s	☐	Street furniture
t	☐	Breakdown patrols
u	☐	Maintenance on Local Government roads?
v		Other (list)
4.2 Pavement Resurfacing Included?	Select...	If yes then estimate of % of network length to be resurfaced during the contract (select from No, <25%, 25-50%, 50-75%, 75-100%, >100%)
4.3 Pavement Rehabilitation included?	Select...	If yes then estimate of % of network length to be rehabilitated during the contract (select from No, <25%, 25-50%, 50-75%, 75-100%, >100%)
4.4 Bridge & Roadside Structure Renewal /strengthening included?	☐	Tick for yes
4.5 Other Specific Inclusions		To be discussed, but may include either the scope of assets, or the scope of responsibilities on the assets. Please describe

4.6	Specific Exclusions		To be discussed, but may include either the scope of assets, or the scope of responsibilities on the assets. Please describe
4.7	Future possible Inclusions		Is there an intention to include some other asset groups into the contract at some future date (maybe as other contracts expire)? If so then describe
4.8	Percentage of value attributed to asset Improvements		What % of the contract value is for improvement schemes such as widening, intersection improvements, realignments, etc? Exclude renewals/rehabilitation and small safety improvements like lane marking or signage upgrades etc.
b	Comments on above		
4.9	% of value of contact value to be spent in first third of contract term		Often there is a need to invest heavily in the early part of the contract to bring the network up to an acceptable condition, or to implement various minor improvement schemes (widening etc.)
b	Comments on above		
4.10	Management structure prior to this contract		What was the overall management arrangement prior to the PBC? Was it Road Authority-Consultant-Contractor, or some other arrangement? Please describe
4.11	Percentage of Services /inputs being delivered from outside the local region		While routine maintenance almost always is completed by local teams, large renewal schemes may be undertaken by resources normally based outside the network area.
4.12	How is asset consumption being monitored/managed through the term of the contract?		Is there a measure such as "average residual life of pavements" or "average age of assets" or similar to ensure that the value of the asset is not degraded.
4.13	Comments on the form of service criteria / performance measures used for road user service and comfort measures.	Select...	It is possible to have PBC service criteria that specify performance in terms of time to correct deficiencies, or the maximum number of deficiencies that are permitted. Which is the predominate form (select from

		time based, number of defects, or broad mix)
4.14 Are they driving the "right behaviors"?	Select...	Is full compliance with the service criteria giving the result that the Road Authority expected, or has the contractor managed to meet the requirements yet the road is not performing as expected? Select from "Yes, Partial, No"
b Comments on above		Any comments on the driving of behaviors through the service criteria?
4.15 How often are the performance measures monitored (answer in months):		
a Management Performance Measures (MPMs)		e.g. inspections, provision of data, quality of asset mgt plans
b Road User Safety & Comfort Measures (RUS&CMs)		e.g. roughness, rutting, skid resistance
c Durability Performance Measures (DPMs)		e.g. falling weight deflectomoter
d Comments on frequency of performance measures		any comments on a-c above
4.16 How do you monitor compliance with the day to day serviceability measures?		Does the client inspect the assets and audit, does the contractor self-audit, does the contractor have to keep detailed maintenance records for auditing etc.?
4.17 Is performance linked to incentive/penalty payments?	Select...	Is compliance with the MPMs, RUS&CMs or DPMs directly linked to incentive/penalty payments?
4.18 General comments on any of the responses above (including clarifications of responses given)		

5.0	Perceptions		
5.1	With reference to the below, w\hat was the original objective(s) of the contract.		Which of the following factor(s) drove the decision to implement the PBC
a	Save money	☐	Tick for yes
b	Better management	☐	Tick for yes
c	Better outcomes (Value for money)	☐	Tick for yes
d	Secure long term funding	☐	Tick for yes
e	Socio Economic	☐	Tick for yes
f	Lenders requirement	☐	Tick for yes
g	Other (specify)		
h	Comments on above		Any clarification on a-g above
5.2	Are the original objectives being met?	Select...	Have the objective(s) above been delivered by the PBC? [For projects that are on-going please make an assessment] Select from Yes, Partially, No
b	Comments		Comments on meeting of the original objectives

5.3	Level of compliance with Specified service levels	Select...	From an overall perspective would compliance with the specified service levels be Excellent, Acceptable, Marginal, Poor
5.4	How do service levels in contract area compare with adjoining areas?	Select...	Are the expectations from the Network Higher, Same or Lower than adjacent Networks? Often PBCs are implemented with an expectation of delivering better than usual performance.
5.5	Assessment of Value for Money.		Scale 1 = poor 10 = Excellent. What is the perception of the contract within the Road Controlling authority?
5.6	Basis of Assessment of Value for Money (Is a copy of analysis available)?	Select...	Select from Cost, NPV, B/C, Performance, Other
b	Specify if other		If Other please describe
c	Comments on assessment of value for money		Comments on a-b above
5.7	How does the pre and post implementation assessments compare? Other Comments	Select...	Is the Value for Money that is being delivered better, same or worse than expected? Select from "Better, Same, Worse, Not Possible to Tell"
5.8	Benefits / strengths of the Model		What are your personal thoughts on the benefits/strengths
5.9	Weaknesses / Dis-benefits of the model		What are your personal thoughts on the weaknesses/dis-benefits
5.10	Client's Satisfaction with the outcomes		Scale 1 = poor 10 = Excellent
5.11	Time from start of contract to reach targeted service level (months)		Was there a period of time provided to the contractor to bring the network up to the required standards, or a period where a lesser standard

			was acceptable (answer in months)?
5.12	What quantum of client or management consultant (i.e. not the PBC) input is required for management of the contract in terms of the following:	Client	Management/Monitoring/ Auditing Consultant
a	Compliance checking (man months per year)		auditing compliance etc.
b	Contract administration (man months per year)		payments etc.
5.13	Can the contract cope with changing client expectations - if so how?		Is there a clear mechanism to handle a change in client expectations (either higher or lower standards, or a different work mix)? Describe the process.
5.14	How have the parties adapted to the new regime	Select...	If the PBC was a new contract form for either the client or contractor, have the parties understood their new roles and responsibilities? Select from No change needed, Both adapted, Client adapted, Contractor adapted)
b	Comments		Any comments on the way the parties adapted to the new regime?
5.15	Would the interviewee recommend another PBC to a similar organization?	☐	Tick for Yes
b	What changes would they recommended?		Describe changes that the client would recommended before implementing another PBC
5.16	Were there any issues that nearly derailed the success of the project? Please describe and get an explanation of how they were overcome		e.g. change of elected officials etc.

5.17 General Comments on any of the responses above (including clarifications of responses given)		

6.0	Specific Issues for Discussion		
6.1	**Social impact [Please define the context of 'local' in your response]**		
6.1.1	Impact of the Contract on the local Community in terms of:		
a	Employment		1= Much Worse, 5 = No change, 10 = Much Better
b	Accessibility to markets, work etc.		1= Much Worse, 5 = No change, 10 = Much Better
c	Economic		1= Much Worse, 5 = No change, 10 = Much Better
d	Environmental		1= Much Worse, 5 = No change, 10 = Much Better
e	Other (specify)		List impact and quantify (using 1-10 scale above)
6.1.2	What was the capacity of the local industry to deliver the contract?	Select...	Irrespective of who won the contract, was the local industry capable of delivering the contract? Yes, Marginal, No
6.1.3	% of work undertaken by foreigners (even if now		What % of the contract inputs (hours) are from

based in the network for the delivery of the PBC)?		staff not normally residing in the Country?
6.1.4 % of work subcontracted to local firms (price)		What % of the contract inputs (on price) is subcontracted to smaller local firms?
6.1.5 How did the parties change in response to the new paradigm?		Was there a noticeable difference in the way the contract parties interacted with each other as a result of the PBC? For instance did the Client understand their role under a PBC, and did the Contractor recognize their new responsibilities? Describe
6.1.6 Comments on Social Impact		Any comments on 6.1 above
6.2 **Risk**		
6.2.1 Which of the following Risks have been transferred to the Contracting Entity		
a Traffic loading	Select...	Select from No, Partial, Full
b Historic construction quality	Select...	Select from No, Partial, Full
c Supplied inventory reliability	Select...	Select from No, Partial, Full
d Supplied condition reliability	Select...	Select from No, Partial, Full
e Quantum of renewal works	Select...	Select from No, Partial, Full
f Rehabilitation/Renewal designs	Select...	Select from No, Partial, Full

g Legislative changes during the contract	Select...	Select from No, Partial, Full
h Weather impacts	Select...	Select from No, Partial, Full
i Accident damage by third parties to the assets	Select...	Select from No, Partial, Full
j Vandalism damage by third parties to the assets	Select...	Select from No, Partial, Full
k Completeness/validity of supplied databases	Select...	Select from No, Partial, Full
6.2.2 Is the risk Transfer considered equitable?	Select...	Select from Yes, Favors client, Favors contactor
6.2.3 Any Lessons on risk Transfer?		Describe lessons learnt on risk allocation or transfer
6.2.4 How is vehicle overloading managed within the contract?		Select from Client risk, Contractor risk and control, Contractor risk with client control
6.2.5 How is the repair of storm damage managed?		Under Lump sum, Shared (contractor responsible for initial works), Client pays extra
6.2.6 Comments on risk		Comments on 6.2
6.3 **Corruption at present**		
6.3.1 To what level is corruption in the local society recognized	Select...	Select from Virtually Nil, Isolated, Wide Spread
6.3.2 Have there been any corruption issues with the current PBC contract?		Please describe issues and solutions

6.3.3 Any positive features of the PBC methodology model with respect to reducing corruption?		Please describe
6.3.4 Any negative features of the PBC methodology model with respect to reducing corruption?		Please describe
6.3.5 Lessons/Comments?		Please describe
6.4 **Innovation**		
6.4.1 List innovations introduced under current contract		e.g. new treatments, new management systems, new plant
6.4.2 What is/is not motivating an innovative environment?		e.g. risk allocation, funding model, contract duration
6.4.3 Lessons/Comments?		
6.5 **Data**		
6.5.1 Comment on completeness of the data inventory at start of contract	Select...	Select from Complete, Complete for all major asset groups, Some gaps, Substantial gaps, Very little
6.5.2 Post contract award, were there any issues caused as a result of the reliability of traffic and traffic loading data?		Did it eventuate that the traffic data that was available for tendering turned out to be unreliable and that a variation to contract or payment was necessary to rectify the situation
6.5.3 What data was provided to tenderers?		
a Traffic data (loadings, volumes, composition)	Select...	None, Very Limited, Limited, Substantial, Comprehensive

b	Maintenance History	Select...	None, <2years , 2-5years, 5-10years, >10years
c	Renewals history	Select...	None, <2years , 2-5years, 5-10years, >10years
d	Road side features (signs, vegetation etc.)	Select...	None, Very Limited, Limited, Substantial, Comprehensive
6.5.4	Lessons/Comments?		
6.6	**Guidance**		
6.6.1	Do you find the following helpful in establishing the PBC?		
a	PMMR Sample Bidding Documents	Select...	Did Not Know Existed, Did Not Use, Helpful, Unhelpful
b	OPRC Sample Bidding Documents	Select...	Did Not Know Existed, Did Not Use, Helpful, Unhelpful
c	Bank Resource Guide	Select...	Did Not Know Existed, Did Not Use, Helpful, Unhelpful
d	Other (specify)		Specify and describe usefulness
6.6.2	Comments on Guidance		Comments on 6.6

12.3APPENDIX C: SUMMARY OF INTERVIEW RESPONSES

The interview responses have been compiled into an Excel spreadsheet. The following pages contain pen portraits of the interviews completed.

PROJECT DETAILS	
Country	ARGENTINA
Project Name	National Highway Rehabilitation and Maintenance
Project ID	P052590
Status	Completed
PBC Type	Asset management focused (Case A)
Road Authority Name	Dirección Nacional de Vialidad (DNV)
Location of Contract	Various spread along the country - This was the second set of CREMA contracts
Extent of PBC Usage & AM Understanding	General Asset Management understanding and practice prior to PBC.
NETWORK DETAILS OF PBC PROJECT	
Description	14,000+ km of mostly rural roads. The network is composed of asphaltic concrete (~40%) and chip seals (~60%).
CONTRACT DETAILS	
Contract Title	CREMA de Argentina
Contract Type	CREMA – 5 years
Value	US$590M (CREMA part only)
Performance Monitoring	The owner agency (DNV) supervises the contract, without outside consultant help.
Asset Management	Contractor has in-house AM team. Approximate 60% of the investment in the first two years (rehab) and the remaining 40% in the remaining of the project – penalties incurred if condition standards are not met
SCOPE OF SERVICES	
Services Included	Initial rehabilitation (of 26-50% of the network) and full range of assets maintained fence-to-fence, including pavement and surfacing renewals.
Services Excluded	
PERCEPTIONS	
Contract Objectives	The main objectives were to preserve the non-concessioned national road network, by stabilizing the physical condition and reduce the long-term life cycle costs, and to increase the participation of the private sector in road rehabilitation and maintenance activities.

Client Satisfaction	Good client satisfaction
SPECIFIC ISSUES	
Social Impact	No information is available. All work contracted with local firms.
Risk	Most risks either partially or fully transferred to the contractor with the exception of legislative changes during the contract period.
Corruption	None
Innovation	Not a focus
Data	Comprehensive traffic data, no maintenance and renewals history data or roadside features data
Guidance	Guidance documentation not used.
KEY LESSONS	
	From the Assessment report (applied in the formulation of APL1): 1. *Performance-based contracts for road maintenance, such as the CREMA contracts, are an efficient tool of maintenance management, and likely to be useful to other countries looking for ways to increase the effectiveness of their road maintenance management systems.* 2. *A road maintenance strategy should include a menu of management options with maintenance carried out by the private sector, thus improving efficiency and reducing the extent of maintenance carried out by government personnel. Over time, the road network should ideally be maintained largely by performance type contract.*

PROJECT DETAILS	
Country	ARGENTINA
Project Name	National Highway Asset Management (APL1)
Project ID	P088153 (only the PBC component of this project is covered in this summary)
Status	Completed
PBC Type	Asset management focused (Case A)
Road Authority Name	Dirección Nacional de Vialidad (DNV)
Location of Contract	Various spread along the country
Extent of PBC Usage & AM Understanding	General Asset Management understanding and practice prior to PBC.
NETWORK DETAILS OF PBC PROJECT	
Description	12,000+ km of mostly rural roads in fair to good condition with daily traffic of 100-20,000+. The network is composed of asphaltic concrete (~40%) and chip seals (~60%).
CONTRACT DETAILS	
Contract Title	CREMA de Argentina
Contract Type	CREMA – 5 years
Value	US$697M
Performance Monitoring	The owner agency (DNV) supervises the contract, without outside consultant help.
Asset Management	Contractor has in-house AM team. Approximate 80% of the investment in the first two years (rehab) and the remaining 20% in the remaining of the project – penalties incurred if condition standards are not met
SCOPE OF SERVICES	
Services Included	Initial rehabilitation (of 26-50% of the network) and full range of assets maintained fence-to-fence, including pavement and surfacing renewals.
Services Excluded	Paving of gravel roads
PERCEPTIONS	
Contract Objectives	The main objectives were o obtain a better management and outcomes and to secure long-term funding. Additional objectives include enhancing road safety and avoiding (reduce) change orders/ cost overruns often encountered in regular contacts.
Client Satisfaction	Good client satisfaction based on acceptable overall performance and good value for money. WB compared "typical" costs in the contact for unit price vs. CREMA (which included maintenance) for an overlay of 5 cm and found that the CREMA contracts were 20-25% more efficient.
SPECIFIC ISSUES	
Social Impact	No information is available. All work contracted with local firms.
Risk	Most risks either partially or fully transferred to the contractor with the exception of legislative changes during the contract period. - The contactors installed scales and control loads (with help from the police) - Repairs are included in the maintenance costs, except for major events (unpredictable events)
Corruption	None
Innovation	Not a focus but it in general it was found that the risk transfer promoted innovation
Data	Comprehensive traffic data, no maintenance and renewals history data or roadside features data
Guidance	Guidance documentation not used.
KEY LESSONS	
	1. Strengths of the model: ✓ Effectiveness: focused on user satisfaction / "value for money" ✓ Efficiency: transfer risk and responsibilities to the contractors, which fostered innovation/ longer term contracts provides incentives for better quality and resource utilization/ lest risk of cost overflows and contact modifications. ✓ Administration: Less biding and supervision requirements/ more predictable flow of payments, which help secure resources for maintenance 2. Weaknesses: ✓ Need to enforce the contact and apply penalties

	✓ If enforcement is not strict, the contracting mechanism loses value ✓ Risk of overdesign instead of finding an "optimum" rehabilitation strategy; to avoid this is important to have good asset management to determine what is needed 3. There has been an increase in user expectations and the DNV has had to increase the standards used for the second batch of contacts (before the contract was set) 4. DNV is considering longer contract 7-10 years because the 5-year period was considered too short.

PROJECT DETAILS	
Country	ARGENTINA
Project Name	Provincial Road Infrastructure Project
Project ID	P070628 (only the CREMA of this project is covered in this summary)
Status	Active
PBC Type	Asset management focused (Case A)
Road Authority Name	Provincial Roads Central Executing Unit/ Local Authorities
Location of Contract	Chubut, Corrientes, Córdoba, Entre Ríos, Neuquén and Santa Fe.
Extent of PBC Usage & AM Understanding	Limited Asset Management understanding and practice prior to PBC.
NETWORK DETAILS OF PBC PROJECT	
Description	~ 2,200 km of mostly provincial roads in fair to good condition grouped in 15 CREMA contracts.
CONTRACT DETAILS	
Contract Title	CREMA Provincial
Contract Type	CREMA
Value	US$129M
Performance Monitoring	The owner agencies supervise the contract, without outside consultant help.
Asset Management	
SCOPE OF SERVICES	
Services Included	Initial rehabilitation (of 71% of the network) and full range of assets maintained fence-to-fence, including pavement and surfacing renewals.
Services Excluded	
PERCEPTIONS	
Contract Objectives	The introduction of the use of performance-based contracts project aims to improve the reliability and management of essential road assets.
Client Satisfaction	There seems to be good client satisfaction.
SPECIFIC ISSUES	
Social Impact	No information is available.
Risk	Most risks either partially or fully transferred to the contractor with the exception of legislative changes during the contract period.
Corruption	None
Innovation	Not a focus.
Data	Comprehensive traffic data, no maintenance and renewals history data or roadside features data
Guidance	Guidance documentation not used.
KEY LESSONS	
	The program is still going but the lessons reported for APL1 are likely applicable.

PROJECT DETAILS	
Country	ARGENTINA
Project Name	National Highway Asset Management (APL2)
Project ID	P095569 (only the CREMA portion of this project is covered in this summary)
Status	Active
PBC Type	Asset management focused (Case A)
Road Authority Name	Dirección Nacional de Vialidad
Location of Contract	Various spread along the country
Extent of PBC Usage & AM Understanding	General Asset Management understanding and practice prior to PBC.
NETWORK DETAILS OF PBC PROJECT	
Description	~ 13,000 km of mostly rural roads in fair to good condition with daily traffic of 100-20,000+. The network is composed of asphaltic concrete over granular of cement-treated bases (~52%) and chip seals (~48%).
CONTRACT DETAILS	
Contract Title	CREMA de Argentina
Contract Type	CREMA
Value	US$1,280M (360M Wb,920M counterpart)
Performance Monitoring	The owner agency (DNV) supervises the contract, without outside consultant help.
Asset Management	Contractor has in-house AM team. Approximate 80% of the investment in the first two years (rehab) and the remaining 20% in the remaining of the project – penalties incurred if condition standards are not met
SCOPE OF SERVICES	
Services Included	Initial rehabilitation (of 26-50% of the network) and full range of assets maintained fence-to-fence, including pavement and surfacing renewals.
Services Excluded	Paving of gravel roads
PERCEPTIONS	
Contract Objectives	The main objectives were (1) to obtain better management, (2) to obtain better outcomes and to (3) secure long-term funding. Additional objectives include enhancing road safety and avoiding (reducing) change orders/ cost overruns often encountered in regular contacts.
Client Satisfaction	Good client satisfaction based on acceptable overall performance and good value for money.
SPECIFIC ISSUES	
Social Impact	No information is available. All work contracted with local firms.
Risk	Most risks either partially or fully transferred to the contractor with the exception of legislative changes during the contract period.
Corruption	None
Innovation	Not a focus but it in general it was found that the risk transfer promoted innovation
Data	Comprehensive traffic data, no maintenance and renewals history data or roadside features data
Guidance	Guidance documentation not used.
KEY LESSONS	
	The program is still going but the lessons reported for APL1 are applicable.

PROJECT DETAILS	
Country	BRAZIL
Project Name	Road Transport Project and other transport projects in Brazil, such as the previous federal loan (Federal Highway Rehabilitation and Decentralization Project (P006532) and BR Goias State Highway Management (P055954)). Note that the project P092990 is still ongoing.
Project ID	P006532, P055954 and P092990
Status	Two completed, one ongoing
PBC Type	
Road Authority Name	
Location of Contract	
Extent of PBC Usage & AM Understanding	25-50% of network managed via PBCs, with moderate level of understanding on AM prior to these contracts.
NETWORK DETAILS OF PBC PROJECT	
Description	An interconnected network of roads in generally poor condition at the outset. Traffic volumes up to 10,000 vpd with up to 50% heavy vehicles.
CONTRACT DETAILS	
Contract Title	Road Transport Project but includes data on Minas Gerais, Bahia, Goias. PREMEF, PROMG, PREMAR, Terceira Via
Contract Type	CREMA contract model used
Value	From US$14million for the 2 year contracts to about US$100million for the 5 year contracts Pay per works completed and inspected per km on a monthly basis. This implies approximately 80% of payment during first 2 -3 years for rehabilitation, the remainder during 3 years of maintenance. Prices are adjusted annually based on Bank formula in contract and national indices published online. Normally the contract is structured based on 4 phases: initial recuperation (6 months), Rehabilitation (2/3/4 years), Maintenance (5 years), localized improvements.
Performance Monitoring	Initially performance was penalized by fines. Currently it is penalized through payment retention. Indicators and standards outlined in specifications for surfacing and maintenance. Monthly inspections measure performance and request for payment is accepted only when performance is in line with completion of standards. The monitoring structure was substantially simplified in follow-up CREMA contracts, and is now down to 11 to 16 indicators for maintenance and 2 indicators for rehabilitation from 99 indicators (11 for work program and 88 for maintenance services management). Some maintenance indicators have become stricter and both the monitoring procedures, now exercised on the basis of random technical audits, and the procedures for correction of defects and penalties, have been simplified. See WB TP #31, 2010
Asset Management	
SCOPE OF SERVICES	
Services Included	
Services Excluded	
PERCEPTIONS	
Contract Objectives	The Project's ultimate development objective is to stimulate higher economic growth by increasing effectiveness in the use of the federal road infrastructure. The objective is to be achieved through (a) support to the first phase of the Federal Road Maintenance and Rehabilitation Program, and (b) a comprehensive program of institutional strengthening activities to improve efficiency and sustainability of road transport investment programs.
Client Satisfaction	Project implementation is considered moderately satisfactory given delay in the execution of the physical component as a result of procurement issues.
SPECIFIC ISSUES	
Social Impact	Almost all contractors were local except for one Portuguese firm.
Risk	
Corruption	
Innovation	Standardization of engineering designs

	Maintenance services and rehabilitation works were to be bid together under contracts covering larger extensions: instead of a typical 80 km length (for rehabilitation) to 130 km (for maintenance) in the traditional input based contracts approach, the new contracts would cover longer road sections from 450 to 600 km per contract. Larger contracts would further contribute to (a) increase construction industry interest in road maintenance and rehabilitation with potential economies of scales, and (b) provide more homogeneous maintenance conditions on road itineraries; A standard bidding document was prepared for the bidding of rehabilitation and maintenance services contracts (most road administrations did not have standardized bidding documents at that time) to reduce time required by road administrations in preparing individual bidding documents and by the General Attorney's office in reviewing such documents. Maintenance and rehabilitation programs monitoring were also improved via the design (and publication) of regular reports objectively consolidating physical and financial progress. Such reports fostered the road administrations' capacity in identifying implementation issues and proposing remedies, and contributed to increasing the transparency on their activities vis-à-vis the Governments and civil society.
Data	Some gaps in data sets present at outset.
Guidance	Based on prior CREMA work.
KEY LESSONS	
	CREMA program's overall efficiency relies on the simplicity of the activities executed under the contracts, focus on simple road rehabilitation works and maintenance services, and streamlining of their preparation, execution, monitoring and managing. The introduction of financial penalties for non-compliance with specified indicators was a complete novelty in civil works contracts, and an attempt to make contractors more accountable for the services they provide. Penalties were introduced initially as fines, which was a mechanism too unfamiliar both for the public and the private sectors (very few notifications were ever made and payments of fines have been even rarer). Penalties are now made through payment retention from the monthly instalments to be made to the contractors. For maintenance, the retention is a predefined portion of the payment related to a specific performance standard (the retention, cumulative per indicator, is weighed proportionally to the evaluated seriousness of potential consequences resulting from unmatched performance) whenever the standard is not achieved. For rehabilitation, payments are made per kilometer when both indicators on roughness and deflection are met. In other words, the contractor is now paid only for the part of the service for which it has performed. Transfer of responsibilities of Road Management to contractor. Better road conditions at reduced costs with reduced management burden with PBC in contrast with input based contracts. Study covers this information. 1) need to adopt model to local specifications, 2) cannot address all flaws in management system, 3) contractors' accountability on rehabilitation is limited, 4) administrations need to be reinforced to manage the contracts. Unfamiliarity with concept. 5-8 years to adapt. First contracts results not achieved all expectations. Temptation to incorporate too many demands not related to road maintenance. Also refer to TP/31(Lancelot 2010)

PROJECT DETAILS	
Country	CHAD
Project Name	
Project ID	P035672
Status	Ongoing
PBC Type	
Road Authority Name	
Location of Contract	
Extent of PBC Usage & AM Understanding	100 % of the network is managed via PBC
NETWORK DETAILS OF PBC PROJECT	
Description	440km of unpaved road network in fair condition
CONTRACT DETAILS	
Contract Title	
Contract Type	
Value	US$12M with full Bank funding
Performance Monitoring	LOS are higher than adjacent and the contractor has delivered on the LOS requirements
Asset Management	Service levels had been defined prior to the contract.
SCOPE OF SERVICES	
Services Included	
Services Excluded	
PERCEPTIONS	
Contract Objectives	Better management of the assets and improved socio-economic outcomes.
Client Satisfaction	Happy that objectives are being met.
SPECIFIC ISSUES	
Social Impact	Contract awarded to a French contractor, with a Cameroonian consultant. Significant social benefits from the project have been delivered.
Risk	
Corruption	Use of the community to help monitor performance reduces the chances of corruption
Innovation	
Data	
Guidance	
KEY LESSONS	
	Demonstration from government that this road does not needs to be paved. Well maintained, gravel did work. Technical solutions for rain problems - water flowed at difference location every time - solution through surface protection Contractor did not know how PBC worked - they all had to learn - was successfully overcome but indicates the need to have a strong change management process if the PBC is a new concept. Community can be strongly involved in the monitoring of performance, and this reduces the chances of corruption.

PROJECT DETAILS	
Country	NIGERIA
Project Name	Rural Access and Mobility Project
Project ID	P072644
Status	Active
PBC Type	Renewals focused (Case B)
Road Authority Name	State Project Implementation Unit
Location of Contract Area	
Extent of PBC Usage & AM Understanding	5-10% of area network under PBC. Not much emphasis on road maintenance, but a lot of focus on new roads for agricultural/economic development.
NETWORK DETAILS OF PBC PROJECT	
Description	460km of mostly rural road in very poor condition at contract start with daily traffic of <100. 90% of length is gravel and 10% of is chipsealed.
CONTRACT DETAILS	
Contract Title	Rural Access and Mobility Project
Contract Type	OPRC - 5 year contract duration. Rehabilitation about 80% of network, with significant front loading of contract.
Value	US$50M
Performance Monitoring	Working with implementation issues to involve the communities to report poor performance.
Asset Management	External AM consultant engaged by client. Client has no input into AM decisions.
SCOPE OF SERVICES	
Services Included	Road maintenance, including pavement and surfacing renewals. Also associated drainage, bridges and traffic services facilities (e.g. signs, barriers),
Services Excluded	Operational requirements including electronic assets (e.g. lighting, signals, ITS), litter, incident response, traffic management etc.
PERCEPTIONS	
Contract Objectives	
Client Satisfaction	New contract, but initial feedback is that the contractor is performing better that expected.
SPECIFIC ISSUES	
Social Impact	
Risk	Some risks partially transferred to the contractor. Client risks include historic construction quality, renewals quantities, renewals design, legislative changes during the contract period, validity of data provided.
Corruption	Clauses in contract that disallow corruption issues seem to be effective.
Innovation	
Data	Substantial traffic data, but limited maintenance or renewals history data.
Guidance	
KEY LESSONS	

PROJECT DETAILS	
Country	TANZANIA
Project Name	Central Transport Corridor Project
Project ID	P078387
Status	
PBC Type	Unpaved roads
Road Authority Name	Tanroads
Location of Contract	
Extent of PBC Usage & AM Understanding	Limited prior understanding of PBC or AM.
NETWORK DETAILS OF PBC PROJECT	
Description	1090 km spread across 6 contracts. Roads are all unpaved (gravel) and carry up to 500vpd
CONTRACT DETAILS	
Contract Title	Central Transport Corridor Project
Contract Type	PBC of unpaved roads based on PMMR model
Value	$xxx over 5 year term
Performance Monitoring	Local consultant does performance monitoring role. Use of average vehicle speed to reflect user experience of road.
Asset Management	No measure on asset consumption for unpaved network
SCOPE OF SERVICES	
Services Included	All routine maintenance, rehab for unpaved network
Services Excluded	
PERCEPTIONS	
Contract Objectives	Better VfM and Social outcomes
Client Satisfaction	Good but unexpectedly high results in socio economic area
SPECIFIC ISSUES	
Social Impact	Major social benefits from having all weather access routes
Risk	Significant transfer of risks to contractor
Corruption	Alternative much larger number of contracts hence could play the numbers game. During the execution there is a risk of contractor paying off the supervision consultant -this is not sustainable given community environment. Community has been informed of contract expectation
Innovation	
Data	Limited, but with rapid change of gravel roads and no asset consumption measure this was less an issue.
Guidance	Used to inform agency
KEY LESSONS	
	Lack of experience of PBC for all parties - outside expertise was needed to make it a success. First facilitator did not know what he was doing, time laps between contract letting and signing of contracts -road worsen during this time. Need to select a supporting consultant on the basis of the quality of advice and not just lowest price. Can use the community to help monitor the performance if the LOS are suitably defined and communicated.

PROJECT DETAILS	
Country	LIBERIA
Project Name	Preparation Of Output And Performance-Based Road Contract - Conceptual Designs And Preparation Of Tender Documents For "Red Light – Gate 15 – Gbarnga – Ganta – Guinea Border" And "Cotton Tree To Buchanan" Roads
Project ID	ICB No: LIBRAMP-MPW/LRTF/OPRC/RGG/001/'10 P113099
Status	
PBC Type	Renewals focused (Case B)
Road Authority Name	Ministry Of Public Works Infrastructure Implementation Unit (IIU)
Location of Contract	Port Buchanan to Cotton Tree
Extent of PBC Usage & AM Understanding	1-5% of area network under PBC with very little Asset Management understanding and practice prior to PBC
NETWORK DETAILS OF PBC PROJECT	
Description	180km of road in very poor condition at contract start with daily traffic of 500-10,000. 25%/75% urban/rural split. 50% of length is asphaltic concrete and 50% of length is earth roads.
CONTRACT DETAILS	
Contract Title	Output- and Performance-based Road Contract (OPRC) (Road Asset Management Contract) For the Design, Rehabilitation and Maintenance of PACKAGE 2 : RED LIGHT – GBARNGA – GUINEA BORDER ROAD, Lot 1: "Red Light – Gate 15 – Gbarnga" Road
Contract Type	OPRC - Lump Sum contract model and 10 year contract duration selected to maximize the confidence over the availability of funds as moderate concerns over long term government stability. The full length of the network is required to be fully reconstructed.
Value	55% to be spent in first third of contract term
Performance Monitoring	Monitoring consultant to be engaged. Liquidated Damages can apply and reduction to Uniform Series of Payments for Service Level non-compliance.
Asset Management	Consultant employed by the contractor.
SCOPE OF SERVICES	
Services Included	Full range of assets maintained fence-to-fence, including all pavement and surfacing renewals, incident response and vegetation control.
Services Excluded	Electronic assets (e.g. ITS) and some operational functions such as street cleaning and litter removal
PERCEPTIONS	
Contract Objectives	Better management, Value for money, secure long term funding, socio economic

Client Satisfaction	Too early, contract not yet awarded. Low tender prices received with concern that price may be unsustainable for the 10 year project.
SPECIFIC ISSUES	
Social Impact	Contract should have very good economic and employment impact on local community
Risk	Risks not transferred to the contractor include data and historic impacts, quantum of renewals works and legislative changes during the contract period.
Corruption	Wide spread
Innovation	
Data	No maintenance or renewals history data. Base line information collected during initial project development phase.
Guidance	OPRC sample bidding documents and bank resource guide
KEY LESSONS	

PROJECT DETAILS	
Country	ZAMBIA
Project Name	Agricultural Project in Zambia
Project ID	P070063
Status	Active
PBC Type	Unpaved roads only (Case C)
Road Authority Name	Road Development Agency
Location of Contract Area	Four contracts – area wide performance based contracts
Extent of PBC Usage & AM Understanding	<1% of area network under PBC with moderate Asset Management understanding and practice prior to PBC
NETWORK DETAILS OF PBC PROJECT	
Description	Four contracts between 160km to 450km of mostly rural road in very poor condition at contract start with daily traffic of <100. Some roads had a traffic increase to 1500/day, average increase of 96%. Full length is gravel.
CONTRACT DETAILS	
Contract Title	Agricultural Project in Zambia
Contract Type	OPRC - 5 year contract duration.
Value	Four contracts totaling US$36M.
Performance Monitoring	External supervision consultant engaged by client. Non-compliance results in payment reductions, maximum payment reduction may lead to termination.
Asset Management	AM provided by independent consultant. Client has no input into AM decisions.
SCOPE OF SERVICES	
Services Included	No maintenance, contract includes rehabilitation and improvements, taking roads being neglected to improved designed roads
Services Excluded	Operational requirements including electronic assets (e.g. lighting, signals, ITS), litter, incident response, traffic management etc.
PERCEPTIONS	
Contract Objectives	Better management, value for money, secure long term funding, socio economic, lenders requirements
Client Satisfaction	Excellent client satisfaction. Exceeded expectations in terms of socio-economic impact within 2 years of contract. Excellent value for money with 30% saving on traditional contracts.

SPECIFIC ISSUES	
Social Impact	Very good impact in terms of local employment, accessibility, economic and environmental benefits
Risk	Most risks partially or fully transferred to the contractor, except legislative changes during the contract period, accident and vandalism damage. Traffic loading increased so significantly the contractor and client shared this risk.
Corruption	Widespread. PBC does not stop corruption only minimize it.
Innovation	
Data	Limited traffic data, and no maintenance or renewals history data.
Guidance	PMMR and OPRC sample bidding documents were helpful
KEY LESSONS	

PROJECT DETAILS	
Country	INDIA
Project Name	Punjab Output and Performance Based Road Contract (OPRC)
Project ID	P090585
Status	Active
PBC Type	Asset Management focused (Case A)
Road Authority Name	Punjab Roads and Bridges Development board
Location of Contract	Bathinda – Mansa – Sangrur area in the Punjab State
Extent of PBC Usage & AM Understanding	<1% of area network under PBC with limited Asset Management understanding and practice prior to PBC.
NETWORK DETAILS OF PBC PROJECT	
Description	200km of rural road in fair condition at contract start with daily traffic of 500-10,000. Full length is asphaltic concrete. Much of the network in reasonable condition but lines, signs and shoulders tended to be neglected and pavement lives are very short.
CONTRACT DETAILS	
Contract Title	Output and Performance Based Road Contract (OPRC) for Improvement, Rehabilitation, Resurfacing and Routine Maintenance Works of Roads of Sangrur-Mansa-Bathinda Contract Area Contract Number PPSRSP/WB/OPRC/1/ICB
Contract Type	OPRC – 10 years
Value	US$147.2M
Performance Monitoring	PWD will appoint a monitoring consultant to act as project manager as per FIDIC. 40% of the network payment is at risk each month using the non-conformance bucket principle. Liquidated damages apply if target lengths are not completed in a given year.
Asset Management	Client intending to engage external AM organization. Client will have limited input into Asset Management decisions.
SCOPE OF SERVICES	
Services Included	Full range of assets maintained fence-to-fence, including all pavements and surfacing renewals.
Services Excluded	Electronic assets (e.g. signals, ITS) and traffic management.
PERCEPTIONS	
Contract Objectives	Better management, Value for money
Client Satisfaction	Generally good client perception that contract will achieve Value for money, although the extent of the investment in the improvement to the strength of the pavement is clouding the issue in the client's mind.
SPECIFIC ISSUES	
Social Impact	Local industry has marginal capacity to deliver the project
Risk	Most risks either partially or fully transferred to the contractor with the exception of quantum of renewals works and legislative changes during the contract period.
Corruption	Wide spread
Innovation	
Data	Very little reliable maintenance history is available due to annual staff movements
Guidance	Referred to similar New Zealand contract documents
KEY LESSONS	
	With changes in client, projects can take a significant amount of energy to get to the point of letting a contract. Need to focus on the benefit of getting to the completion of an Asset Management Plan, with the procurement model a secondary issue.

PROJECT DETAILS	
Country	INDIA
Project Name	Anclhia Padesh Performance Based Contract
Project ID	
Status	3 contracts let, a number of others in the pipeline
PBC Type	OPRC – with significant initial improvement
Road Authority Name	Andhra Pradesh Road Development Corporation
Location of Contract	Throughout the State
Extent of PBC Usage & AM Understanding	Until recently there was very little usage of PBC and a low level of understanding. They had established a number of "long term performance based maintenance contracts" about 10 years ago which, while based on the OPRC sample bidding document, used an input based payment mechanism and met with limited success.
NETWORK DETAILS OF PBC PROJECT	
Description	A total of 36 Contracts are proposed covering one total of 10,000kms
CONTRACT DETAILS	
Contract Title	
Contract Type	A strong focus on rehab and resurfacing
Value	300 – 350 million Rupees
Performance Monitoring	
Asset Management	
SCOPE OF SERVICES	
Services Included	
Services Excluded	
PERCEPTIONS	
Contract Objectives	Improved condition and better management of the asset
Client Satisfaction	Too early to state but indications are positive
SPECIFIC ISSUES	
Social Impact	Too early to measure
Risk	Most manageable risks transferred to contractor
Corruption	
Innovation	Too early to measure
Data	
Guidance	The early contract land of PBC focus reinforced the need for both guidance
KEY LESSONS	
	The early contracts, while purporting to be performance based contracts, where in fact input based. This reflected the poor understand of PBC that existed in the industry at the time. Once an informed advisor was in place the client and the contracting industry quickly embraced the concepts and there has been strong interest from contractors in the new performance based model. Problems with the early contract could have damaged the reputation of the PBC contract, reinforcing the need for informed advisors along with better training materials and documentation.

PROJECT DETAILS	
Country	PHILIPPINES
Project Name	Manila North Road and Manila South Road
Project ID	P039019
Status	Expressions of Interest Called for Consultancy
PBC Type	OPRC
Road Authority Name	DPWH
Location of Contract	Manila
Extent of PBC Usage & AM Understanding	We understand that this is their first OPRC initiative
NETWORK DETAILS OF PBC PROJECT	
Description	450km of Road
CONTRACT DETAILS	
Contract Title	N/A to be decided
Contract Type	N/A to be decided
Value	N/A to be decided
Performance Monitoring	N/A to be decided
Asset Management	N/A to be decided
SCOPE OF SERVICES	
Services Included	Consultancy services for Preparation of Contract Document
Services Excluded	
PERCEPTIONS	
Contract Objectives	Improved Service and increased Efficiencies
Client Satisfaction	N/A
SPECIFIC ISSUES	
Social Impact	
Risk	
Corruption	High in this part of the World so needs careful consideration
Innovation	
Data	
Guidance	
KEY LESSONS	
	Just embarking on the project, after many delays

PROJECT DETAILS	
Country	EGYPT
Project Name	PBC of Maintenance of Paved Roads
Project ID	P100276
Status	**Canceled - REFER WRITE UP ON THIS PROJECT IN APPENDIX D**
PBC Type	
Road Authority Name	Egypt General Authority for Roads, Bridges and Land Transport (GARBLT)
Location of Contract	
Extent of PBC Usage & AM Understanding	No prior PBCs, although grant in 2005 was provided to develop a framework and provide staff training to GARBLT, consultants and contractors in PBCs
NETWORK DETAILS OF PBC PROJECT	
Description	
CONTRACT DETAILS	
Contract Title	
Contract Type	
Value	Contract not awarded
Performance Monitoring	
Asset Management	
SCOPE OF SERVICES	
Services Included	
Services Excluded	
PERCEPTIONS	
Contract Objectives	
Client Satisfaction	
SPECIFIC ISSUES	
Social Impact	
Risk	An equitable sharing of risks was prepared. Most of the risks associated with the quality of old pavements was passed to the contractor
Corruption	
Innovation	
Data	
Guidance	
KEY LESSONS	
	1. Careful planning studies and piloting is strongly recommended before rolling out larger PBCs in a country. The expectations of these pilots (especially in terms of cost savings) should not be high. 2. When moving from a public contracting situation to the use of the private sector, the historic costs of works may not be an accurate reflection of the costs going forward owing to the different way overheads etc. are dealt with for public works departments. 3. The procurement law in Egypt is very strict in not permitting contracts to be more than 10% above estimates – which for a new approach provides real challenge to successful letting of a contract. 4. The quality of work suffers when costs are too low 5. A stable funding arrangement is essential for private contract maintenance to be considered. 6. Trying to implement PBCs in a resourced constrained environment (Egypt was in a construction boom) will severely restrict participants in the process. 7. The network size must be set to be optimal for the works required – and that the 100km selected was likely too small for this. 8. The duration of the contract should be long enough to include at least one period maintenance application over the entire network Refer to Appendix D for further details on lessons learnt.

PROJECT DETAILS	
Country	POLAND
Project Name	Road Maintenance & Rehabilitation 2 Project
Project ID	P088824 / P096214
Status	
PBC Type	Asset Management focused (Case A)
Road Authority Name	General Directorate for National Roads and Motorways (GDDKiA)
Location of Contract Area	
Extent of PBC Usage & AM Understanding	<1% of area network under PBC with limited Asset Management understanding and practice prior to PBC
NETWORK DETAILS OF PBC PROJECT	
Description	28km of rural road in excellent condition at contract start with minimum daily traffic of 1,000-10,000. Full length is asphaltic concrete.
CONTRACT DETAILS	
Contract Title	Complex road maintenance of S3 express road between 54+012 km and 81+613 km (non-WB project, but run by GDDKiA – General Directorate of Public Roads and Motorways)
Contract Type	5 years contract for maintenance (both summer and winter) right after construction of a new road section (so called expressway = semi-motorway standard)
Value	US$7.3M
Performance Monitoring	If the contractor does not meet the required performance standards, client counts penalty points. One points costs 400 PLN (145 USD). Performance can impact on contract term.
Asset Management	Completed in-house by the contractor. Client has limited input into Asset Management decisions.
SCOPE OF SERVICES	
Services Included	Full range of assets maintained fence-to-fence
Services Excluded	Electronic assets (e.g. signals, ITS) and incident response. Renewals not included.
PERCEPTIONS	
Contract Objectives	Save money, Value for money
Client Satisfaction	Too early, no data
SPECIFIC ISSUES	
Social Impact	No significant social impact
Risk	Risks transferred to the contractor include contract variables such as traffic, construction quality, supplied data reliability and completeness
Corruption	Isolated
Innovation	
Data	Complete data available
Guidance	Proformas and guidance documents not used
KEY LESSONS	
	Project is a trial after prior initiatives not making progress.

PROJECT DETAILS	
Country	AUSTRALIA
Project Name	Sydney North East Performance Specified Maintenance Contract
Project ID	1
Status	Active
PBC Type	Asset management focused (Case A)
Road Authority Name	Roads and Traffic Authority (RTA) of New South Wales
Location of Contract	North East Sydney
Extent of PBC Usage & AM Understanding	1-5% of area network under PBC with very little Asset Management understanding and practice prior to PBC.
NETWORK DETAILS OF PBC PROJECT	
Description	550km of mostly urban road in fair to good condition with daily traffic of 100-20,000+. Most of the network is asphaltic concrete, with 5% chipsealed and 10% concrete.
CONTRACT DETAILS	
Contract Title	Sydney North East Performance Specified Maintenance Contract
Contract Type	PSMC – 10 years
Value	AUD$350M
Performance Monitoring	Reduction in payment if contractor does meet the performance standards specified in the contract.
Asset Management	Contractor has in-house AM team. Client has AM team but has limited input into Asset Management decisions.
SCOPE OF SERVICES	
Services Included	Full range of assets maintained fence-to-fence, including pavement and surfacing renewals.
Services Excluded	Electronic assets (e.g. signals, ITS, lighting) and traffic management. Also all structural assets.
PERCEPTIONS	
Contract Objectives	Key driver was to retain a different delivery mechanism, outside of delivering "in-house". Other objectives are value for money, secure long term funding.
Client Satisfaction	Good client satisfaction based on acceptable overall performance and good value for money. Road authority considers they have got the right drivers and have a contractor that cares about what they are doing.
SPECIFIC ISSUES	
Social Impact	No real impact
Risk	Most risks either partially or fully transferred to the contractor with the exception of legislative changes during the contract period.
Corruption	None
Innovation	Not a focus
Data	Comprehensive traffic data, moderate maintenance and renewals history data
Guidance	Guidance documentation not used
KEY LESSONS	

PROJECT DETAILS	
Country	AUSTRALIA
Project Name	Term Network Contract 5
Project ID	2
Status	Closed
PBC Type	Asset management focused (Case A)
Road Authority Name	Main Roads Western Australia
Location of Contract	Wheat belt South and Great Southern Regions of Western Australia
Extent of PBC Usage & AM Understanding	100% of area network under PBC with moderate Asset Management understanding and practice prior to PBC. AM principles were used prior to contracts but more emphasis was placed on measuring AM outcomes and the success of AM through the contracts.
NETWORK DETAILS OF PBC PROJECT	
Description	3,168km of mostly rural state roads in good condition at contract start with daily traffic of 500-20,000. 97% is sealed roads and 3% is asphaltic concrete.
CONTRACT DETAILS	
Contract Title	Term Network Contract 5
Contract Type	PSMC - 10 years. Contract evolved into a more relationship based alliance style contract.
Value	AUD$158M
Performance Monitoring	Two types of performance measures used, short term Road Maintenance Intervention Parameters (RMIPs) and long term Asset Condition profiles. Penalty payments for non-achievement.
Asset Management	Client not initially intended to have input. However, contract evolved over the ten years and client organization took more of asset management functions back in-house as they felt they had "lost control" of their asset.
SCOPE OF SERVICES	
Services Included	3,168km of State Roads (total maintenance and asset management). 30,506km of Local Roads where the contractor had to maintain regulatory road signs and road marking. Also included pavement surfacing renewals.
Services Excluded	Electronic assets (e.g. signals, ITS, lighting) and traffic management. Also structural repairs and improvements to bridge structures.
PERCEPTIONS	
Contract Objectives	A primary driver (political) was for Main Roads to get out of the business of delivering maintenance on its networks and become a "Network Manager" for the State Government. Other objectives were to: Save money, Value for money, secure long term funding, opportunities for local industry, opportunities for innovation
Client Satisfaction	Acceptable performance, but Main Roads identified three critical lessons. These were: • Main Roads must have involvement, influence and control of asset management • Good relationships are critical to achieve best outcomes and risk must be appropriately apportioned • Must have flexibility to respond to change
SPECIFIC ISSUES	
Social Impact	Good impact on employment, accessibility, economic and environmental drivers.
Risk	Full risk transferred to contracting entity, favors the client.
Corruption	None
Innovation	Biggest Innovation was moving the contract to a relationship style contract that operated similarly to an alliance to deliver the services on a "best for network" basis.
Data	Limited condition and inventory data, which was not complete and inaccurate. Very little historical maintenance data.
Guidance	Guidance documentation not used
KEY LESSONS	

PROJECT DETAILS	
Country	AUSTRALIA
Project Name	Integrated Services Arrangements
Project ID	3
Status	Active
PBC Type	Asset management focused (Case A)
Road Authority Name	Main Roads Western Australia
Location of Contract	Wheat belt which lies east of Perth in Western Australia
Extent of PBC Usage & AM Understanding	100% of area network under PBC with full Asset Management understanding and practice prior to PBC.
NETWORK DETAILS OF PBC PROJECT	
Description	4,000km of rural road in good condition at contract start with daily traffic of 100-10,000. 97% of length is chip sealed, 3% is asphaltic concrete.
CONTRACT DETAILS	
Contract Title	Integrated Services Arrangements
Contract Type	PBC – 5 years. Client managed.
Value	US$150M
Performance Monitoring	Contractor and client jointly monitor performance. Penalty payments for non-achievement. Performance can impact on contract term.
Asset Management	Client provides AM services. Consortia also have AM capability to supplement client capacity and capability.
SCOPE OF SERVICES	
Services Included	Full range of assets maintained fence-to-fence, including all pavements and surfacing renewals.
Services Excluded	Electronic assets (e.g. lighting, signals, ITS) and delineation.
PERCEPTIONS	
Contract Objectives	Building capability and capacity within client organization and local industry. Ensure sustainable business proposition to encourage positive behaviors from industry. Other objectives include: better management, value for money, secure long term funding.
Client Satisfaction	Reasonable client satisfaction based on acceptable overall performance and reasonable value for money. Assessment of based on it being early days in contract but contract form judged to provide good potential.
SPECIFIC ISSUES	
Social Impact	Some employment and economic benefits
Risk	Most risks partially transferred to the contractor with the exception of legislative changes during the contract period, accident damage and vandalism. Lessons learned from earlier PBC that equitable sharing of risk is required to get best long term outcomes for client, in particular authority over asset management decisions.
Corruption	None
Innovation	Too early to comment
Data	Data complete for all major asset groups, however limited data provided as not considered essential in risk profile for contractor due to payment methodology e.g. direct cost reimbursable.
Guidance	Took philosophy from other areas e.g. UK, but didn't use any contract forms as developed specifically for local environment
KEY LESSONS	

PROJECT DETAILS	
Country	AUSTRALIA
Project Name	EastLink PPP
Project ID	4
Status	Active
PBC Type	Public-Private Partnership (PPP) (Case D)
Road Authority Name	VicRoads is State Road Authority. ConnectEast is the designated (by law) Road Authority for the extent of the PPP
Location of Contract	Melbourne, Australia
Extent of PBC Usage & AM Understanding	16% of area network under PBC with general Asset Management understanding and practice prior to PBC.
NETWORK DETAILS OF PBC PROJECT	
Description	39km of urban road with daily traffic of 20,000+. Full length is asphaltic concrete and was new at commencement of contract.
CONTRACT DETAILS	
Contract Title	EastLink PPP
Contract Type	PPP Privately financed, build, operate, maintain and hand back to State after 40yrs (4yrs construction, 35yrs operation)
Value	
Performance Monitoring	KPI regime with the State VicRoads for AM (and others), and required to have an independent audit of this at a high level though. Financial penalties imposed for Concessionaire not meeting KPIs.
Asset Management	Transfield Services are maintainers, now have an alliance contract with ConnectEast. ConnectEast have "in house" AM capability which makes all AM recommendations to ConnectEast. VicRoads has limited to no input to AM as they have assigned the road to the Concessionaire.
SCOPE OF SERVICES	
Services Included	Full range of assets maintained fence-to-fence, including pavement and surfacing renewals. Also maintenance of off road facilities (e.g. over height detectors in advance of roads in contract, ramp closure signs / ITS, wetlands associated with road).
Services Excluded	Signals and traffic management.
PERCEPTIONS	
Contract Objectives	Save money, secure long term funding
Client Satisfaction	Excellent level of compliance and value for money. Provided asset six months early, currently delivering level of service required. Casualty crash rate 0.25-0.33 of the State's other urban freeway network. High quality asset providing high level of service for minimal cost outlay (e.g. land acquisition cost only by State Road Authority).
SPECIFIC ISSUES	
Social Impact	Good impact on employment, accessibility, economic and environmental drivers. Travel times have been significantly improved.
Risk	Full risk transferred to contracting entity, favors the client.
Corruption	None
Innovation	• Alliance environment incentivizes innovation and efficiencies. Focus on road user drives focus on improvements. Construction incentives to get it built early to start tolling earlier drove innovation. • Construction: new concrete batch plant in local area - good for local employment. • New asset management system implemented
Data	Actual traffic volumes were 30% lower than the predicted volumes (not desirable as tolls were proportionally lower). Risk of this fell to ConnectEast.
Guidance	Did not know guidance documentation existed
KEY LESSONS	

PROJECT DETAILS	
Country	NEW ZEALAND
Project Name	WBOPDC PBC001
Project ID	5
Status	Nearing end of 10 year period
PBC Type	
Road Authority Name	New Zealand Transport Agency & Western Bay of Plenty District Council
Location of Contract	North Island of New Zealand in the Western Bay of Plenty
Extent of PBC Usage & AM Understanding	Extensive use of various forms of PBC and sound AM understanding
NETWORK DETAILS OF PBC PROJECT	
Description	Combination of state highway and local authority roads. SH's provide main spine of the network, with local roads feeding off the SH network.
CONTRACT DETAILS	
Contract Title	PBC001 Performance Based Contract
Contract Type	Type A – roads in range of condition
Value	NZ$240M (approx US$200) over 10 years
Performance Monitoring	Originally a 5 year contract given for Data Collection Contract to MWH Ltd. Last 5 years has been in house independent auditors. There were some tentative (approx. 35%) LOS proposed as non-contractual levels prior to the final development and trial as part of PBC documentation. The remainder were defined as part of PBC. Some minor non compliances are on file. No major non conformances
Asset Management	Client helps develop the FWP
SCOPE OF SERVICES	
Services Included	All except for signals. Road settlement (first 200mm) in some circumstances.
Services Excluded	Signals, Paper roads and unformed roads
PERCEPTIONS	
Contract Objectives	Focus on managing the costs associated with traffic growth in the region, as well as reduce costs, etc.
Client Satisfaction	Council is happy
SPECIFIC ISSUES	
Social Impact	No real change
Risk	Risk is transferred to best party to manage it.
Corruption	LOS are transparent, measured, managed, delivered and communicated to User Groups. Cost certainty Reduced tendering and compliance costs Good tension applied on spending money
Innovation	Two clients securing a single supplier, but with separate tracking of costs etc.
Data	
Guidance	Based on prior NZ PBCs/PSMCs
KEY LESSONS	
	Some perverse behavior has been avoided by discussion with the Council and NZTA. Eg Residual seal life drivers were promoting sealing when unnecessary for least whole of life cost. After discussions with council, Inroads sealing monies have been redirected to seal widening. Also on unsealed roads, some LOS were set too high (e.g. 70mm corrugations) for safety and practicality. Inroads intervene at more like 40mm. LOS has been improved.

PROJECT DETAILS	
Country	NEW ZEALAND
Project Name	Northland PSMC
Project ID	6

Status	Completed
PBC Type	Type A – roads in a range of condition
Road Authority Name	NZTA
Location of Contract	Far North of New Zealand
Extent of PBC Usage & AM Understanding	Extensive use of various forms of PBC and sound AM understanding
NETWORK DETAILS OF PBC PROJECT	
Description	750km State Highway network in a low traffic area (peak of 20,000 in Whangarei), but of significant tourism areas.
CONTRACT DETAILS	
Contract Title	PSMC002
Contract Type	PSMC
Value	US$60M over 10 years
Performance Monitoring	External consultant appointed to monitor performance.
Asset Management	Client comments on the FWP but does not set or approve it
SCOPE OF SERVICES	
Services Included	All general mtce/renewals plus traffic growth and slip risks to a limit
Services Excluded	Signals and ITS equipment
PERCEPTIONS	
Contract Objectives	Save money and better outcomes
Client Satisfaction	For this contract - perhaps underpriced, client management was weak, understanding of the model, remoteness of network. Commercial arrangement between contractor and sub-consultant
SPECIFIC ISSUES	
Social Impact	
Risk	
Corruption	Not an issue
Innovation	incident management, skid, slip management, slip repairs,
Data	Complete
Guidance	Did not know of WB guidance, used prior NZ experience
KEY LESSONS	
	If contract is underpriced, then the contract will be problematic. Better control under-pricing. Client must have experience in contract management role, have a clear understanding for underpinned quantities. Client must understand the network needs prior to tendering. Smaller network. Cap additional work on a value.

PROJECT DETAILS	
Country	NEW ZEALAND
Project Name	Waikato PSMC 001 SH3
Project ID	5
Status	Completed
PBC Type	Network Management – Case A
Road Authority Name	New Zealand Transport Authority
Location of Contract	Waikato
Extent of PBC Usage & AM Understanding	Extensive use of various forms of PBC and sound AM understanding
NETWORK DETAILS OF PBC PROJECT	
Description	460km of rural state highways, carrying between 500 and 20,000 vpd.
CONTRACT DETAILS	
Contract Title	Waikato PSMC 001 SH3
Contract Type	10year Performance Specified Maintenance Contract
Value	NZ$80m
Performance Monitoring	This was the first PSMC in NZ and used a combination of time and quantity based criteria.
Asset Management	PSMC Contractor (Transfield) initially used external consultant, subsequently moved inhouse to contractor. Contractor responsible for all AM activities to deliver the contracted performance.
SCOPE OF SERVICES	
Services Included	All services (no ITS on the network)
Services Excluded	Some risks
PERCEPTIONS	
Contract Objectives	Better management and value-for-money
Client Satisfaction	Excellent compliance with service levels, with subsequent contract let under similar model
SPECIFIC ISSUES	
Social Impact	Better environmental outcomes, otherwise no change
Risk	Significant (yet equitable) transfer of risks across the full spectrum – with combination of full and partial risk transfer
Corruption	Not an issue
Innovation	Use of innovative products (now considered routine). Testing the quality of patch repairs to help meet asset consumption performance measures.
Data	Some gaps in data, but no issues. Good inventory and traffic data, with <5yr maintenance and renewals history.
Guidance	Did not use.
KEY LESSONS	
	Better data results in better prices. Use of a contract Governance Board to help with the running of the contract.

PROJECT DETAILS	
Country	NEW ZEALAND
Project Name	Auckland Motorway Alliance
Project ID	8
Status	Active
PBC Type	Alliance
Road Authority Name	New Zealand Transport Authority
Location of Contract	Auckland
Extent of PBC Usage & AM Understanding	Extensive use of various forms of PBC and sound AM understanding
NETWORK DETAILS OF PBC PROJECT	
Description	Motorway network carrying up to 200,000 vpd, with ITS equipment etc.
CONTRACT DETAILS	
Contract Title	
Contract Type	10 year Alliance contract, broken into 3 notionally equal Target Outturn Cost (TOC) periods
Value	Approximately NZ$50m per year
Performance Monitoring	Extensive performance monitoring in terms of both the contractual performance (delivery of reports on time etc.) and the customer based levels of service.
Asset Management	Fully integrated team consisting of the client (NZTA), contractor and consultant – responsible for all outcomes/outputs.
SCOPE OF SERVICES	
Services Included	All maintenance, operation and renewals, plus various minor works.
Services Excluded	Traffic operations (control of signals etc.) and management of the Auckland Harbor Bridge (potentially to be included at a later date)
PERCEPTIONS	
Contract Objectives	Reduce costs and improve customer levels of service
Client Satisfaction	Client very satisfied.
SPECIFIC ISSUES	
Social Impact	Nothing significant
Risk	Very strong risk management processes in place. Includes identified risks that can be 'managed' by altering the works programs, and other risks that the AMA has to carry out of profits.
Corruption	Not an issue
Innovation	Extensive use of innovations that drive efficiencies of work, as this is where the profits can be gained.
Data	Collection and manipulation of routine maintenance and inventory data is included (high speed data is collected nationally). AMA has developed numerous innovative tools for data management that are now available nationally.
Guidance	None used.
KEY LESSONS	
	Challenge of "selling" the benefits of a new contract model into the road agency should not be underestimated. Even with factual data, skeptics will remain. Different overhead structure between contractors and consultants makes selecting the best team more challenging. Need a strong leader to unite the client/consultant/contractor into one.

12.4 APPENDIX D: LESSONS LEARNT FROM EGYPT

World Bank Draft May 2009

Performance-based Contracting of Maintenance of Paved Roads

Lessons Learnt from a Test Case in Egypt

(Working Paper)

Introduction

1. Many Roads Departments are trying to increase the efficiency and effectiveness of the road network through improved maintenance management and execution. This is motivated by the recognition that a country's public highway network often constitutes one of the largest and most expensive assets owned by the government. A less-than-optimal system for the management and maintenance of that asset, results in huge losses for the national economy in the form of road deterioration and substantial reductions in road asset value but, even more so, in the form of increased vehicle operation costs for road users.

2. The World Bank has been in the forefront among donors over the last 5-7 years in many countries, articulating the potential benefits of Output[13] and Performance-based Road Contracting (OPRC), and advocating the World Bank's sample bidding document and specification. However, after a number of pilot projects in various developing countries, the concept when applied to deteriorated paved roads is still to be proven as a cost effective method to improve the level of service for road users. Some of the pilot maintenance projects have weaknesses in coverage (too few km); others have too short terms (3-4 years) partly to avoid or reduce substantially periodic maintenance and rehabilitation work. These limitations affect the costs of contractors, make supervision costly and preclude a reasonable economy of scale. Only by applying the concept (possibly in an improved form) on a wide network and over sufficient years one can expect to get the benefits of *performance-based contracting* (PBC) demonstrated.

3. In making decisions on PBC of road maintenance, in particular involving periodic maintenance such as asphalt resurfacing, it is critical to take into account lessons learned on other Bank-supported pilot projects, including what are considered success factors and under what conditions a country pilot is appropriate. Very few relevant evaluations are available on past Bank pilot projects for paved roads. Below is a first attempt at compiling what the emerging experiences are for Egypt after the implementation of a pilot project was postponed in 2008 due to lack of competition among contractors and high costs.

Background

[13] The use of the term "output based" could be replaced by "outcome based" as all traditional works contracts are output based in the sense that no payments are made for inputs (materials, labor and equipment). (See Annex 1 for a definition of often used maintenance terms).

4. The PPIAF has provided two grants to support the General Authority for Roads, Bridges and Land Transport (GARBLT) in Egypt in developing capacity to prepare and implement a performance based contract for road maintenance. The first grant (2005) financed the assessment by an international consultant of the viability of PBC for Egypt, developed a Framework for implementation, and provided staff training for GARBLT, contractors and consultants. This grant was fully utilized and a Framework Document for PBC for Egypt was the main output besides the draft tender document and PBC training presentations. Based on this, GARBLT included funding in its road maintenance budget for a 100 km long pilot project to try out PBC in Egypt.

5. The second grant in 2007 provided support for a consultant[14] to assist in tendering, provide training in evaluation and support implementation of the pilot besides much needed additional training for staff of GARBLT, contractors and consultants. Tenders were invited from 10 prequalified contractors, both public corporations and private entrepreneurs. Of the 10 firms, only five actually purchased the tender documents and only one firm (a public corporation, The Arab Contractors) submitted a bid. The bid was technically acceptable, but the bid price was close to three times the estimated cost. As a result the tender was rejected, and the planned implementation support by the consultant to help GARBLT in supervising the pilot project was cancelled.

Lessons Learned

6. The facilitating consultant to GARBLT prepared a Final Report and tender documents for the pilot. The Final Report presents the facilitating consultant's views on the pilot. The below assessment is an attempt at drawing some further more general lessons from the pilot. This would hopefully help in deciding whether or not to try to retender the pilot after appropriate adjustments to the tender concept and framework for Egypt.

7. The compiled lessons learned cover both the PPIAF supported grants. Only the lessons that seem to have region-wide relevance are included in the draft recommendations at the end. The lessons learned are grouped under seven themes, each being an area where international experience seems to suggest one should pay special attention when designing and implementing PBC in a new country.

1. Piloting PBC and related factors

8. Carefully planned studies and piloting of a PBC project is strongly recommended before rolling out PBC in road maintenance for larger network-wide applications. The Egypt pilot PBC project went through extensive preparation to make sure it would be successful. Not only was a country specific Framework document prepared based on sector work by the Bank. But also the road maintenance administration in GARBLT was given training and coaching as well as support during tendering. There was also no lack of commitment from the Government of Egypt to undertake a successful pilot project as witnessed by the allocation of funding for the pilot entirely by local budget resources.

9. Related to this is the necessity not to set the expectations too high! Small pilots are not going to show cost reductions, and close management follow-up is needed to achieve a reasonable quality of service. It must be clearly understood that substantial improvement in the condition of the road and reduction in cost of maintenance will take time to accomplish and cannot be expected as a result of the pilot only.

[14] Awarded to the same firm under competition.

10. The pre-bidding cost estimate by the Government turned out to be more important than expected. The procurement law in Egypt allows road contracts to be awarded to the lowest evaluated responsive bidder on the condition that the bid price is not more than 10 percent higher than the government's official cost estimate. This is a very strict condition that may have to do with the fact that in the past only government owned public road corporations were allowed to carry out road works in competition through tendering. Therefore the cost estimates may have been too much based on rates that have historically been low and also related to road construction projects that allow for more efficient use of equipment and staff. Currently this has changed and the private contractors are permitted to bid against public corporations and do so successfully even under such constraints. However, regular construction contracts are less risky. There is also evidence that quality of work suffers when rates are set (artificially) low, as the case may have been in Egypt over the last few years[15]. To address this particular problem under the pilot, the consultant assisted GARBLT in estimating the costs based on the requirements of the bid document. In spite of this, it seems that not enough allowance was included in the cost estimate for higher than usual risks and the relatively small size of the contract. For a future pilot to succeed it may be necessary to ask for a waiver from the current law for a certain time period in order for the market to be able to set rates for performance based road maintenance contracts.

2. Secure Funding

11. A stable funding mechanism is essential for private contract maintenance to be considered. Such arrangements should secure financing on a multi-year basis. For example, using road maintenance funds or other earmarking arrangements may be necessary when multi-year commitments are not possible over the recurrent budget. In the case of Egypt's road sector, GARBLT has no restriction in this respect, and the budget allocation for last year included the first installment in a budget request for continued funding for the next four years.

12. In fact, it turned out that GARBLT had far too much funds available for maintenance last year, and was unable to spend them on other programmed expenditures such as a planned reduction of the maintenance backlog. The main reason for this is the saturated construction market in Egypt. The high oil prices last year caused the government to award far more contracts for new construction of roads than the local construction industry could absorb. With full order books, public as well as private contractors have no eagerness for a small maintenance contract with complicated tender documents and with multi-year performance specifications and penalty clauses. In this respect, and as it turned out, it seems that the timing of the pilot was unfortunate. The situation has now changed somewhat and the current oil prices may be more conducive to a retendering, since budget funds for new construction of roads are not readily available to the same extent.

3. Size and Scope of Performance Based Contracts

13. Performance based contracts covering more substantial networks with extensive asphalt repair works will improve interest and competition, also from large contractors. The trend in Latin America and elsewhere (New Zealand) has been towards larger and longer term contracts and large contractors in order to reduce the cost of supervision and improve economies of scale. In the case of Latin America it seems the road network for maintenance should be 400-500 km or more to justify a reasonable permanent equipment fleet engaged in maintenance. However, in the case of the pilot in Egypt this would have been very risky and possibly may have excluded the private sector. The private road contractors are still relatively small compared to the public corporations. Accordingly, the proposed arrangements for

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[15] *Reference –Carl Bro Road Asset Management Study 2006, Bank Road Sector Review 2008).*

about 100 km of roads to be maintained initially under the pilot, seemed appropriate. But the cost of maintenance would increase as the network size is less than optimal. In retrospect, it seems that this and other related factors were not taken adequately into account.

14. There also seems to be good arguments for PBC contracts to be long enough to include at least one periodic maintenance application for the full length of the road network in order to maximize potential longer term benefits. This has to do with the deterioration cycle of a road pavement constructed for a 20 year life; it normally requires a reseal or new wearing course twice before reaching the end of the theoretical design life (after 7 and 13.5 years on average). Such resurfacing is also called periodic or pre-emptive maintenance (see Annex 1). The degree of truck overloading, local climate and quality/uniformity of construction do affect the need for and timing of such periodic maintenance interventions.

15. In theory, pre-emptive resurfacing should be placed early enough, and well before significant rutting is visible (< 1 cm) or before temperature induced cracking can penetrate through the bituminous layers and expose lower layers to water[16]. By doing the resurfacing early on, there is no structural degradation and the life of the pavement is extended with good skid resistance.

16. In many cases road administrations in developing countries are not providing such preventive maintenance at the right point in time, often postponing it until structural problems have already developed and there is visible distress. The road maintenance policy applied in Egypt seems to allow deterioration to take place to such an extent that it may not be possible to preserve the integrity of the pavement of the road. No asphalt overlay can adequately repair the under-laying damages when cracks are several millimeters and rutting above 2 cm. When visible distress have progressed too far you have in effect a backlog of deferred maintenance works. Such roads will have more unpredictable performance, to a large extent depending on: the quality of the original pavement works; any overloading of trucks, the timing of rehabilitation works; and the quality of such works (latent performance risk).

17. In the case of Egypt the size of the backlog of maintenance works has been quite large as pointed out in several studies (*Bank Road Financing Study for Egypt 2008)*; increases in GARBLT' s maintenance budget since 2006 have allowed the Authority to start reducing this backlog. Also the quality of road works in the past has been questioned by consultants (*World Bank study on road maintenance - 2005*) possibly caused by relaxed supervision of public contractors in combination with low construction rates. Therefore, the future performance of old road pavements may be difficult to predict without extensive condition surveys and pavement testing.

18. The Bank sample bidding document may not cover these issues adequately even when adapted. It suggests that the document is not to be used if the upfront rehabilitation works needed are exceeding 30 percent of the contract amount. But a contractor and a road administration often have quite different views on such need for any given road length. This requirement effectively excludes much of the urgent sections of the road network from performance based road maintenance contracts as the most urgent backlog of deferred maintenance in all cases would have considerable rehabilitation and often sections that need deep repair and reconstruction. Also the cost of routine maintenance goes up as contractors tend to include overlay on the non-rehabilitated sections of the project in the monthly routine maintenance price just in case this would be needed before the end of the contract period.

19. The Bank sample bidding document also requires the contractor either to rely on third party condition surveys or to do necessary survey work of the pavement and decide how much to rehabilitate up front and later. During the contract period the contractor takes all pavement performance risks, the

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[16] *There is an old Irish saying that "a good road has a tight roof and a dry cellar."*

Employer, who should have the best information on pavement condition and historic performance data, takes none.

20. The pilot road section in Egypt was carefully selected taking these and other concerns into consideration. Judging from the low interest among bidders, and the fact that the only bidder included extensive upfront repairs and a full length asphalt overlay in year three of the contract, indicate that the pilot road had questionable condition in the view of the bidder. For a new pilot to be successful in Egypt changes has to be made to this. At a minimum, the performance risks and incentives have to change. One way would be to make rehabilitation and periodic maintenance payable by rates as and when needed (determined jointly by GARBLT and supervision consultant with input from the contractor). This could be done prior to the bidding, so as the amount of works to be included in the contract's Bill of Quantities would be known by the bidders, who would then price accordingly their bids. This is the case, for example, with the CREMA contracts in Latin America, leaving other routine maintenance works for performance based implementation. Extended warranty periods on such upfront works could also be reconsidered.

4. Contracting Arrangements and Competition

21. Competitive tendering in Performance Based Contracting is supposed to result in a reasonable (market) cost of maintenance if not significant cost savings compared to "force account" works. But the case of Egypt shows that such "saving" can disappear and lead to increased costs if there is not enough competition. In this respect the existence of public road construction corporations in Egypt is a positive feature and important element of the competition in the sector. To avoid award of overly expensive contracts to the private sector in for example remote areas, commercially independent but publicly owned corporations are allowed to compete. In the pilot PBC contract in Egypt the structure of the contract including the sharing of risks may not have been optimal. This, in combination with a saturated contracting industry led to only one bid by a public corporation with a cost that was three times what GARBLT considered a reasonable cost estimate.

22. In order to carry out a successful PBC pilot in Egypt many factors need to be addressed at the same time:

- Lower the cost for contractors to prepare bids. This could be achieved by conducting independent assessments (surveys) of the pilot road's pavement condition for interpretation by the bidders. There may be additional information such as as-built drawings and road inventory that could be made available. Also, for road sections that need rehabilitation up-front, engineering design of such rehabilitation works could be carried out prior to the bidding.

- The tender document could have arrangements for partnering and collaboration between the contracting parties to make decisions on when best to undertake major repairs. [This may lead to unfair competition, with the possibility of different levels of "inside" information being provided to the bidders].

- Local contractors complain that there is a lack of discipline among GARBLT supervisors, as often the contractor is instructed to undertake work that is not in the contract. This uncertainty adds to the cost of road works and should be addressed, for example by allowing all additional and emergency road works to be payable by output (rates).

- Contractual adjustments as well as renegotiation of contracts are happening in many cases, affecting efficiency and competition, and are late signs of a failed process. By removing some of

Box:	Example of a Table of Contents from a Maintenance Manual
8200	**PAVED ROADWAY MAINTENANCE**
8201	Scope
8210	Paved Roadway Routine Maintenance
8211	Paved Roadway Cleaning
8212	Rutting and Depressions Repair
8213	Pothole Patching, Edge Break and Surface Failures Repair
8214	Unpaved Shoulder Grass Removal
8215	Paved Roadway Grass Removal
8216	Crack Sealing
8217	Bleeding Repair
8217	Edge Break Repair
8218	Salt Blisters Repair
8219	Other Paved Roadway Routine Maintenance
8220	Paved Roadway Periodic Maintenance
8221	Fog Spray
8222	Resealing (includes all types of resealing, such as chip seal, sand seal, Otta seal, slurry seal etc.)
8223	Bituminous Overlay
8224	Unpaved Shoulder Regravelling and Edge Drop Repair
8225	Unpaved Shoulder Reshaping

the most critical risks in the pilot contract, one would reduce the likelihood of this happening. A simpler tender document and a good translation of the bid document would be helpful.

- For periodic maintenance, rehabilitation works and other major works such as pavement reconstruction, the maintenance contractor could be asked to be responsible for the design of these repairs as well as execution of the physical works. This could promote innovation and would put all performance responsibilities for such works on the contractor.

5. Level of Service Issues

23. To move from a single pilot to extensive deployment of performance based contracts a robust inventory of the network is required, undertaken on a regular basis preferably by consultants. This will give a good understanding of the past performance of the road assets included as well as desired performance or condition. A road asset management strategy has been developed for GARBLT, but the full implementation of this has not progressed as well as hoped for.

24. Experience from Latin America in particular seems to suggest that targets for performance levels of services should be determined from a road user and general public viewpoint, and the performance levels should be set appropriately (and not too high resulting in an excessive allocation of funds). It is not clear that the performance criteria were set too high in this pilot contract, but the contractor did include a full asphalt overlay. In the future this can be avoided by carrying out an engineering design of rehabilitation works prior to the bidding. Also, the amount of unpredictable emergency works to be undertaken without extra payments can be set too high, increasing regular monthly routine maintenance costs as the only way for contractor to be compensated.

25. From the comments made by contractors after the cancellation of the proposed pilot, a Road Maintenance Manual describing all road maintenance activities is lacking for Egypt and essential even for a pilot. Such a standard reference and source of good practice for road maintenance management would provide guidance not only to contractors but also other stakeholders on maintenance standards, specifications and operational procedures for maintenance works. It would allow the contractors to price the bids better and for supervision of performance to be more effective. Even when maintenance is undertaken in-house or using contracts based on unit rates, technical maintenance standards would be helpful. An example from Botswana of such a manual is provided in a text box on this page and some corresponding data sheets are given in Annex 2 as examples.

6. Personnel/Training

26. Having appropriately technically skilled staff is considered a crucial factor for managing road maintenance. This applies to both to the Owner/Employer as well as the private sector (contractors and consultants). Training in maintenance management and PBC management in particular is essential and has been an integral part in all phases of the assistance to GARBLT. Also contractors and consultants have been given training in all steps of the pilot project to make sure that the concepts are understood. This reduces the risk of receiving irresponsible bids as well as frequent requests for renegotiations of the PBC contract or even worse, - a default by the contractor.

27. Capacity building in GARBLT was also taken seriously to help manage the process of tendering the pilot contract, in evaluating the bids and contract award. A well-qualified consultant was provided to provide on-the-job training for GARBLT's office staff and inspectors, as this is also essential for a successful pilot.

28. Given all human resources - and institutional development invested in GARBLT and the contractors it is unfortunate if a piloting of PBC cannot take place sometime in the near future while the training provided is still fresh.

7. Allocation of Risks

i. Equitable sharing of risks:

29. An understanding of the risks associated with a pilot road maintenance project is required and this was made clear in the tender document. But it is less clear if the risks were shared equitably. Most of the risks associated with the old pavement was put on the "shoulders" of the contractor.

30. Experiences elsewhere indicate that equitable allocation of risks is critical, and that risk should rest with the organization best able to manage and resource it. Competitive tendering and good prices require full understanding of financial and network risks. A key lesson mentioned above is the lack of a good road inventory and independent pavement conditions survey for tendering purposes. The contractors had to undertake such survey work as part of the preparation of proposals.

ii. Axle load risks

31. A particular concern among road contractors in Egypt is that a large percentage of trucks carry loads in excess of the authorized maximum. The penalty for overloading is unrelated to distance traveled and far too low to deter the truckers from carrying excessive loads. Unless overloading is extreme, trucks are allowed to continue with the load after paying the fine. Such policies are misplaced and cause systemic overloading of axles that in combination with high tire pressure result in excessive deterioration of road pavements and reduced performance and life expectancy. This problem is compounded when road pavements have questionable or variable construction quality.

32. GARBLT may not be able to change such bad practices in the short term. However, one could incorporate the procurement, supply and installation of axle load weighing equipment in a new pilot PBC contract. Even technical staff to operate and manage the weighing station could be provided by the contractor. However, the authorities enforcing regulations would have to start offloading excess cargo when a truck does not comply with maximum axle loads instead of collecting insignificant fines. Officials allowed to instruct offloading and levy increased fines would remain under the responsibility of GARBLT and the traffic police because of the legal complexity of other types of arrangements. But the contractor could provide equipment and safe storage facilities.

iii. Complexity of the Bank sample document

33. Possibly the Bank sample bidding document adds to the perception of risks among contractors by its utter complexity especially for non-native English speakers. This is aggravated by the impression that the document seems to try to cover too much: It is supposed to be applicable for 20 year road development concessions, gravel road maintenance contract of short duration, as well as all sizes of performance based paved road maintenance contracts. When one tries to do too much with one document there is a danger of not doing anything really well. And success of pilot projects is crucial in the sense that the whole PBC approach as a PPP can be discredited by a poorly conceived or implemented pilot projects. As a minimum it would help if the sample bid document could identify the country conditions under which a pilot contract is not advisable. [17]

Conclusions and Recommendations:

(a) PBC Pilot projects by their very nature will inevitably have shortcomings that are associated with size, duration, coverage and risks that consequently require expectations not to be set too high in terms of costs, quality of service, and response time.

(b) Before pilot projects are undertaken, a sector review would be helpful in identifying areas of particular risks and help in taking account of international PBC experience. Drafting a Framework for introduction of performance based road maintenance contracts is essential.

(c) PPIAF grants are very helpful in providing funding for developing a framework, capacity building and country specific PBC tender documents. In cases with high uncertainty about the condition and performance of pavements of pilot PBC project, detailed condition surveys should be provided for tendering purposes. This may require other funding sources for implementation of a pilot due to costs associated with such surveys.

(d) In cases where upfront detailed survey work cannot be done to determine extent of needed rehabilitation, one could consider allowing the contract to include detailed testing of the pavement during an early stage of implementation, to be carried out by the contractor but with participation by the road agency. Required deep repairs and rehabilitation sections should jointly be agreed upon and paid for under (for example) a significant contingency item in the contract using rates for emergency works. The rehabilitation design could also be done by the contractor using rates provided in the contract. This can be simplified by carrying out engineering design of the rehab works prior to the bidding.

(e) A country specific PBC tender document for a pilot project following the Bank's sample or standard bidding document can be quite complex even in English language. Much care should be taken to have such documents professionally translated to avoid word for word translation that may be difficult to interpret when preparing bids (or in case of disputes during implementation).

(f) Cost estimates of pilot projects would have to be updated close to bid opening in case of rapid inflation, and include adequate allowance for contractors' risks that will be reflected in the rates.

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[17] An alternative to the Bank sample bidding document is simply the WB Standard Bidding Document. The adaptation is relatively simple – the bill of quantities would remain unchanged for the items to be paid by the traditional approach, or "rates." For the performance based part of payments, one would add a line (or lines) to the bill of quantities specifying the unit as "month". The Bank adopted this approach in Serbia for the two pilot PBC contracts. The government has considered the result satisfactory and now intends to extend such PBC approach to most of the Serbian national road network.

Price adjustment clauses in the contract need to cover all key inputs including labor, and cover all payments not just rate-based items in the Bill of Quantities. Finally, one cannot just apply rates from historical construction contracts, but allow for the market to set the costs of maintaining the current road network.

(g) The reputation of the road agency in contract management and its discipline in making timely payments is also a factor that affects costs and contractors' willingness to prepare bids for maintenance projects. Saturating the construction market with new construction of roads (some with questionable rates of returns), while a huge backlog of maintenance and rehabilitation works remains unaddressed is a self-defeating expenditure policy that not only Egypt is suffering from.

(h) A Road Maintenance Manual describing all road maintenance activities is essential even for a pilot maintenance contract. It would provide guidance for contractors as well as in-house providers of maintenance services and would set standards, specifications and operational procedures for maintenance works on both paved and unpaved roads.

(i) Capacity building before piloting PBC of road maintenance cannot be over-emphasized. But without practical on-the-job training in an implementation of the pilot, much of the theoretical learning will be lost after some time. It is therefore essential that training of road agencies, contractors and consultants is followed up with hands on experience through tendering, award and implementation.

(j) A good road inventory and upfront pavement condition surveys could help in reducing risks and cost of the pilot contract. Consideration should be given to include this as a deliverable by the contractor in addition to the design of critical repair and rehabilitation works in the early stage of the pilot contract.

(k) Incorporate procurement, supply and installation of axle load control equipment in a new pilot PBC contract. Even allowing the contractor's staff to operate and manage the controls could be considered, while leaving the instructions to offload and issuance of penalty citations to the enforcement authority.

(l) Simplify the OPRC sample bidding document, or adapting the WB Standard Bidding document, and have a specific bidding document issued for maintenance of paved roads. Special considerations should be given to introduce clauses and specifications aimed at reducing risks in pilot projects, and to identify conditions under which PBC is inappropriate. Carry out professional translation of the bidding documents into key languages not leaving it entirely to piloting road administrations.

Annex 1: Glossary of widely used terms in road maintenance.

Road Conditions

Good. Paved roads substantially free of defects and requiring only routine maintenance. Unpaved roads needing only routine grading and spot repairs.

Fair. Paved roads having significant defects and requiring resurfacing or strengthening. Unpaved roads needing reshaping or resurfacing (re-gravelling) and spot repair of drainage.

Poor. Paved roads with extensive defects and requiring immediate rehabilitation or reconstruction. Un-paved roads needing reconstruction and major drain- age works.

Road Maintenance and Improvement Works

Routine maintenance. Local repair of roadway and pavement; grading of unpaved surfaces and shoulders; regular maintenance of road drainage, side slopes, verges, traffic control devices, and furniture; roadside cleaning, dust and vegetation control, snow or sand removal, and maintaining rest areas and safety appurtenances.

Resurfacing. Pre-emptive re-graveling an unpaved road or resurfacing a paved road (with a thin asphalt overlay, a surface treatment, or a seal coat) to preserve its structural integrity and restore ride quality. A paved road normally needs resurfacing at the transition from good to fair condition, provided the volume of traffic justifies retaining it in good condition. Resurfacing is sometimes called "periodic maintenance," even though all maintenance activities are periodic. Rehabilitation. Selective repair, strengthening, and shape correction of pavement or roadway (including minor drainage improvements) to restore structural strength and ride quality. The term "strengthening" is sometimes used to describe a specific category of pavement rehabilitation involving the application of overlays. Costs of rehabilitation for paved roads, however, rise steeply as a pavement deteriorates from fair to poor condition.

Reconstruction. Renewing the road structure, generally using existing earthworks and road alignments, to remedy the consequences of prolonged neglect or where rehabilitation is no longer possible.

Restoration. Major rehabilitation and reconstruction works considered together.

Betterment. Road improvements related to the width, alignment, curvature, or gradient of road (including associated resurfacing and rehabilitation works) to improve traffic speed, safety, or capacity. Betterment works are not considered maintenance activities except for ancillary road rehabilitation or resurfacing operations. Costs can vary considerably, depending on the geometric improvements.

New construction. Constructing a paved, gravel, or earth road on a new alignment; upgrading a gravel or earth road to paved standards; providing additional lane capacity; or constructing additional carriageways, frontage roads, grade-separated interchanges, or multilane divided highways.

Source: Road Deterioration in Developing Countries. Causes and Remedies. World Bank Study, 1989.

ANNEX 2: Examples of a Maintenance Manual with performance specification.

FEATURE	PAVED ROADWAY	CODE: 8200
INTERVENTION	BITUMINOUS PAVED ROADWAY PERIODIC MAINTENANCE	CODE: 8220

Scope

This intervention comprises the following activities:

8221 Fogspray
8222 Resealing (includes chip seal, sand seal, Otta seal, slurry seal or others as directed)
8223 Bituminous Overlay
8224 Unpaved Shoulder Regravelling and Edge Drop Repair
8225 Unpaved Shoulder Reshaping
8229 Other Bituminous Paved Roadway Periodic Maintenance

Service Quality Standard/
Key Performance Indicator(s) (KPI(s))

The Service Quality Standard for this intervention shall normally be controlled in accordance with the threshold levels and response times given for each of the Activities 8221 to 8229.

However, in certain cases the Engineer may opt to select one or more Key Performance Indicators to represent the performance of the whole intervention. The Engineer may then verify that the required Service Levels have been complied with through monitoring of the KPI(s), without having to monitor the performance of all activities.

The Key Performance Indicator for Intervention 8220 shall be as shown in the table below.

Threshold Level - Response Time

Service Level A		Service Level B		Service Level C	
Threshold Level	**Response Time**	**Threshold Level**	**Response Time**	**Threshold Level**	**Response Time**
Deteriorated surface, surface "lean" and "hungry" or pavement defects in the opinion of the Engineer	4 w	Deteriorated surface, surface "lean" and "hungry" or pavement defects in the opinion of the Engineer	4 w	Deteriorated surface, surface "lean" and "hungry" or pavement defects in the opinion of the Engineer	4 w

FEATURE	PAVED ROADWAY	CODE: 8200
INTERVENTION	BITUMINOUS PAVED ROADWAY PERIODIC MAINTENANCE	CODE: 8220
Activity	Fogspray	CODE: 8221

Defects, Main Causes, Effects

Defect: Lean, uneven chip seal surface texture, close-spaced fine cracking.

Main Causes: Worn out surface, loss of binder, loss of aggregate, binder dried out or deteriorated, inadequate maintenance.

Effects:

- Ingress of water.
- Untidy appearance.

Purpose and Description

The purpose of this activity is to:

- Slow down further deterioration of the surface and restore traffic safety and trafficability.
- Activity 8221 includes supplying and applying diluted emulsion onto a "dry" and "hungry" surface of paved roadways to seal small cracks and surface voids and to slow down oxidation, and prevent raveling. Where road markings exist, including reflective studs, these shall be reinstated to the approved standard and cleaned, respectively.

Service Quality Standard

- Fogspray shall be carried out within the response times given in the table below as directed by the Engineer, ascertained by relevant condition survey. For activity 8221 the response time shall be until fogspray operations start.

Threshold Level – Response Time

Service Level A		Service Level B		Service Level C	
Threshold Level	**Response Time**	**Threshold Level**	**Response Time**	**Threshold Level**	**Response Time**
Lean and hungry surface, in the opinion of the Engineer	4 w	Lean and hungry surface, in the opinion of the Engineer	4 w	Lean and hungry surface, in the opinion of the Engineer	6 w

FEATURE	PAVED ROADWAY	CODE: 8200
INTERVENTION	BITUMINOUS PAVED ROADWAY PERIODIC MAINTENANCE	CODE: 8220
Activity	Resealing	CODE: 8222

Defects, Main Causes, Effects

Defect: Lean, uneven, "dry" and "hungry" surface texture.

Main Causes: Brittle surface, binder oxidation, loss of aggregate, inadequate maintenance.

Effects:

- Reduced riding comfort.
- Traffic hazard.
- Ingress of water.
- Untidy appearance.

Purpose and Description

The purpose of this activity is to:

- Slow down further deterioration of the surface and restore traffic safety and driving conditions.
- Activity 8222 includes supplying and applying an approved seal as directed by the Engineer to the surface of existing bituminous paved roadways. It includes, but is not limited to chip seal , sand seal, Otta seal or slurry seal, and the use of "SAMI" if required. Where a surface seal covers existing road markings and/or reflective studs, the Activity will also include the application of temporary road markings (spotting).

Service Quality Standard

- There shall not be isolated stripped patches exceeding Nm^2 in area or P% loss of aggregate
- Resealing shall be carried out within the response times given in the table below as directed by the Engineer, ascertained by relevant condition survey. For activity 8222 the response time shall be until resealing operations start.

Threshold Level – Response Time

Service Level A		Service Level B		Service Level C	
Threshold Level	**Response Time**	**Threshold Level**	**Response Time**	**Threshold Level**	**Response Time**
Lean, uneven, "dry" and "hungry" surface texture	4 w	Lean, uneven, "dry" and "hungry" surface texture	4 w	Lean, uneven, "dry" and "hungry" surface texture	4 w

FEATURE	PAVED ROADWAY	CODE: 8200
INTERVENTION	BITUMINOUS PAVED ROADWAY PERIODIC MAINTENANCE	CODE: 8220
Activity	Bituminous Overlay	CODE: 8223

Defects, Main Causes, Effects

Defect: Deteriorated surface and pavement defects.

Main Causes: Worn out surface, loss of aggregate, inadequate maintenance.

Effects:

- Pavement structure deterioration.
- Reduced riding comfort.
- Traffic hazard.
- Ingress of water.
- Untidy appearance.

Purpose and Description

The purpose of this activity is to:

- Slow down further deterioration of the surface and/or the pavement structure to restore traffic safety and trafficability.
- Activity 8223 includes supplying and applying a bituminous overlay in accordance with SSRBW SERIES 4000: ASPHALT PAVING AND BITUMINOUS SURFACING. Where an overlay covers existing road markings, the Activity will also include the application of temporary road markings (spotting).

Service Quality Standard

Overlay shall be carried out within the response times given in the table below or as directed by the Engineer ascertained by relevant condition survey.

Threshold Level – Response Time

Service Level A		Service Level B		Service Level C	
Defects	**Response Time**	**Defects**	**Response Time**	**Defects**	**Response Time**
Deteriorated surface and pavement defects	4 w	Deteriorated surface and pavement defects	4 w	Deteriorated surface and pavement defects	4 w

FEATURE	**PAVED ROADWAY**	**CODE:** 8200
INTERVENTION	**BITUMINOUS PAVED ROADWAY PERIODIC MAINTENANCE**	**CODE:** 8220
Activity	**Unpaved Shoulders Regravelling and Edge Drop Repair**	**CODE:** 8224

Defects, Main Causes, Effects

Defect: Accumulation of shoulder defects, such as washouts, inadequate cross fall, ruts and pavement edge drops.

Main Causes: Loss of shoulder material, inadequate maintenance.

Effects:

- Reduced run off.
- Lack of lateral support may lead to roadway edge breaks.
- Traffic hazard; reduced area for traffic to pull off the roadway.
- Ingress of water.

Purpose and Description

The purpose of this activity is to:

- Restore adequate functioning of the shoulders
- Reinstall shoulder in order to restore a smooth transition between the paved carriageway and shoulder to ensure traffic safety.
- Activity 8224 includes supplying and applying approved shoulder material to unpaved shoulders to correct shoulder crossfall, drop off and/or reduced shoulder width.

Service Quality Standard

- Unpaved shoulders shall not have drop-offs exceeding T mm for a length of 100 m.
- Unpaved shoulders shall be repaired within the response times given in the table below:

Threshold Level – Response Time

Service Level A		Service Level B		Service Level C	
Threshold Level	**Response Time**	**Threshold Level**	**Response Time**	**Threshold Level**	**Response Time**
T=75	3 w	T=75	4 w	T=75	5 w

FEATURE	PAVED ROADWAY	CODE: 8200
INTERVENTION	BITUMINOUS PAVED ROADWAY PERIODIC MAINTENANCE	CODE: 8220
Activity	Unpaved Shoulder Reshaping	CODE: 8225

Defects, Main Causes, Effects

Defect: Accumulation of shoulder defects, such as washouts, inadequate cross fall, ruts and pavement edge drop.

Main Causes: Loss of shoulder material, inadequate maintenance.

Effects: Reduced run off.

- Lack of lateral support may lead to roadway edge breaks.
- Traffic hazard; reduced area for traffic to pull off the roadway.
- Ingress of water.

Purpose and Description

The purpose of this activity is to:

- Restore the proper functioning of unpaved shoulders.
- Reinstall shoulder surface to maintain a smooth transition between pavement and shoulder to ensure traffic safety.
- Activity 8225 includes all works to correct shoulder crossfall, drop off and/or reduced shoulder width.

Service Quality Standard

- Unpaved shoulders shall not have transverse washouts more than 150 mm deep.
- Unpaved shoulders shall not have drop-offs exceeding T mm for a length of 100.
- Correct crossfall (between 3.0 -4.0%) shall be maintained on the shoulder.
- Unpaved shoulders shall be repaired within the response times given in the table below:

Threshold Level – Response Time

Service Level A		Service Level B		Service Level C	
Threshold Level	**Response Time**	**Threshold Level**	**Response Time**	**Threshold Level**	**Response Time**
T=50	2 w	T=50	3 w	T=50	4 w
Defects – Response Time					
Gullies deeper than 150 mm for a length of 50 m.	2 w	Gullies deeper than 150 mm for a length of 50 m.	3 w	Gullies deeper than 150 mm for a length of 50 m.	4 w

12.5 APPENDIX E: PUNJAB RISK ALLOCATION TABLE

Contract Risk Profile				
Risk Description		**Contractor Risk**	**Employer's Risk**	**Risk Boundary**
1	Legislative changes during contract period		Risk excluded	Verified adverse Price, Resource or Time Implications
2	Government of Punjab policy changes		Risk excluded	Verified adverse Price, Resource or Time Implications
3	Changes to Network size, except as provided for in the contract documents		Risk excluded	Verified adverse Price, Resource or Time Implications
4	Maintaining private access-ways and pedestrian facilities located outside the kerb line and/or edge of seal in defined Built-up areas.		Risk excluded	Verified adverse Price, Resource or Time Implications
5	Stockpile and Disposal Sites	Risk included		Intractable Landowner Issues
6	Land Entry Agreements	Risk included		Intractable Landowner Issues
7	Identification and reporting to the Employer of the need for forestry clearances required for Improvement and/or Safety Works	Risk included		Provision of an unencumbered RoW
8	Seeking and obtaining approval for forestry clearances		Risk excluded	Verified adverse Price Resource or Time Implications
9	Land acquisition or other clearances required for Improvement Works		Risk excluded	Verified adverse Price Resource or Time Implications
10	Changes to Contract Performance Measures (MPM's, RUS&CPM's, and RDPM's), see Maintenance Specification		Risk excluded	Verified adverse Price Resource or Time Implications
11	Changes to annual surfacing renewal and pavement rehabilitation quantities, see Maintenance Specification, Section 5	Risk included		Employer instructed changes beyond annual preservation quantities

Contract Risk Profile				
Risk Description		**Contractor Risk**	**Employer's Risk**	**Risk Boundary**
12	Changes to the Five (5) Year Program	Risk included		Employer instructed changes beyond annual preservation quantities
13	The identification and pricing of previously unidentified drainage improvements within both rural and Built-up zones within the right of way.	Risk included		Employer instructed pricing of additional works
14	The construction of drainage renewals or other improvement works including safety improvements not identified on the conceptual designs.		Risk excluded	Verified adverse Price Resource or Time Implications
15	Where the recorded and verified **Increase** in cumulative Annual Traffic growth for the defined road section exceeds the annual threshold of **9%** (arithmetic) for Cars, Buses or Trucks, **and** the Contractor is able to clearly demonstrate that this increase in traffic growth above the threshold value will result in an increase in the costs to the Contractor for either routine maintenance works or the cost of pavement rehabilitation, surfacing renewal or improvement works, **and** the OPRC has met all quality and LOS requirements that could reasonably impact on the area of claimed additional cost.		Risk excluded	Verified adverse Price Resource or Time Implications
16	The impact of all identified traffic overloading on existing pavements and in the design for all new or rehabilitated pavements and surfacing renewals	Risk included		Limit of ESA growth as specified in the contract document

Contract Risk Profile				
Risk Description		**Contractor Risk**	**Employer's Risk**	**Risk Boundary**
17	Surfacing Renewal programmed in the FWP on Capital works Contracts completed by other contractors.	Risk included		Employer instructed changes beyond annual preservation quantities
18	The design, construction and post construction performance of all surfacing, surfacing renewal, pavement rehabilitation and improvement works completed by the contractor until the end of the maintenance defects period.	Risk included		Traffic loading thresholds, unforeseen natural phenomenon, Emergency Works
19	Accuracy and completeness of information provided in Asset Inventories from the Government of Punjab	Risk included		Registers provided or available at the time of tender
20	Additional/reduced maintenance requirements including road marking associated with work undertaken by other contractors on the network. The Contractor will be given the opportunity to jointly inspect physical works completed by other contractors prior to accepting the subsequent maintenance responsibility.	Risk included		Traffic loading thresholds, unforeseen natural phenomenon, Emergency Works
21	Work required to address vibration and road noise complaints as a result of work completed by the Contractor.	Risk included		Agreed environmental threshold limits
22	Reinstatement of all utility services as a result of work completed by the Contractor under this contract.	Risk included		Trenches and installations completed by others

Contract Risk Profile				
Risk Description		**Contractor Risk**	**Employer's Risk**	**Risk Boundary**
23	Monitoring of observed utility maintenance and installation activities and the reporting of inadequate pavement, surfacing or road shoulder formation re-construction following the installation or maintenance of utility services by other contractors to the Employer.	Risk included		Non-notification by the Employer to the Contractor of work by other contractors within the RoW
24	All required consents and approvals for all work completed under this contract	Risk included		Additional Works ordered by the Employer
25	Renewal of culverts less than 600mm internal diameter or equivalent	Risk included		Remaining functional and structural capacity >50%
26	All structural bridge repairs		Risk excluded	Specified Routine Maintenance Requirements
27	Provision of Bailey or other temporary bridge stock or construction		Risk excluded	Loss, damage or closure of existing structures or road sections
28	Routine Superficial Bridge Inspection and Reporting	Risk included		Employer ordered special inspection
29	Routine Superficial Inspection and Reporting after a flood (or similar) event	Risk included		Employer ordered special inspection
30	Bridge and Other Structure Cleaning	Risk included		Existing assets
31	Bridge and Other Structure Detritus Clearing	Risk included		Existing assets
32	Bridge and Other Structure Protective Coated Surfaces Maintenance (Components Above Deck Surface Level)		Risk excluded	Maintenance of existing protective coatings required greater than 5% of the total coated area.

Contract Risk Profile				
Risk Description		**Contractor Risk**	**Employer's Risk**	**Risk Boundary**
33	Bridge and Other Structure Timber Component Maintenance; with the exception of any: • sightrails • handrails		Risk excluded	Maintenance of existing structural components required beyond routine maintenance needs
34	Maintenance (cleaning, painting, repair, or replacement) of timber sight rails and timber handrails on and approaching bridges.	Risk included		Unforeseen natural phenomenon, Emergency Works
35	Bridge and Other Structure Debris Clearing	Risk included		Existing assets
36	Bailey Bridge or other temporary bridge Inspection and Maintenance	Risk included		Existing assets
37	Specific Maintenance	Risk included		Existing assets
38	Maintaining privately owned signs and signs owned by other authorities within the RoW		Risk excluded	Work under Agreed Variation
39	Maintenance of all standard and non-standard signs and supports with a sign area less than or equal to **5.0 m²** area.	Risk included		Unforeseen natural phenomenon, Emergency Works
40	Maintenance of heavy vehicle rest areas or any associated facilities.		Risk excluded	Work under Agreed Variation
41	Reinstatement work funded as agreed Emergency Works.		Risk excluded	Work under Agreed Variation
42	Existing subsidence sites and new sites where the depth of subsidence is 100mm or less in a single event.	Risk included		Up to the extent defined
43	Accuracy of inventory and previous maintenance activity information provided to contractor	Risk included		Information and data relating to completed works at the time of bidding.

Contract Risk Profile				
Risk Description		**Contractor Risk**	**Employer's Risk**	**Risk Boundary**
44	A. Completing all asset inventory updates for physical work completed under this contract. Updates shall be completed in accordance with the Employer's Database Operations Requirements B. Insufficient, inaccurate or inadequate quality assurance data or inventory data collected during or after the OPRC.	Risk included		Assets within the RoW
45	Liability for damages to services caused by the Contractor's operation	Risk included		The value of the Contracting Entity's Insurance Cover
46	A. Incident Response to make the site safe and secure. B. Attendance and work at the site beyond making the site safe and secure.	Risk included	Risk excluded	Provision of a safe, secure site
47	Routine maintenance and repair of crash and other damage, including graffiti, vandalism, theft etc. by third parties as well as all damage resulting from the contractor's operation; **with the exception of any:** **(i) crash damage to:** ☐ the concrete components of bridges ☐ specific crash protection devices e.g. cushions **(ii) vandalism (other than graffiti), theft etc. by third parties and crash damage to:** ☐ all standard and non-standard signs and supports with a sign area **greater** than **5.0 m²** area	Risk included		Assets maintained under the OPRC within the RoW

Contract Risk Profile				
Risk Description		**Contractor Risk**	**Employer's Risk**	**Risk Boundary**
48	All additional work required to achieve the required level of service for signs and pavement marking for each respective road category from that existing at the time of contract award	Risk included		Appropriate standard for the road classification
50	Management of RoW encroachments impacting upon the contractor's ability to satisfactorily complete Routine Maintenance Works or the construction of Pavement Rehabilitation, Surfacing Renewal or Improvement Works.	Shared		Contracting Entity's Reporting Obligations
51	Waterlogged pavements – Maintenance prior to identification and reporting by the Contractor	Risk included		Until definitive evidence provided to the Employer on waterlogging impact
52	Waterlogged pavements – Maintenance post construction of Contractor designed pavement treatments	Risk included		Unforeseen natural phenomenon, Emergency Works
53	Resources for the control of traffic and assistance with planned events and festivals within or adjacent to the RoW		Risk excluded	Work under Agreed Variation