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Technical Assistance for Implementation of
Institutional Reforms in the Road Sector of Uttar Pradesh

REPORT TO IMPLEMENT PERFORMANCE-BASED WORKS
CONTRACTING GENERALLY IN PWD PROJECTS
(FINAL)

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Glossary

ADB  Asian Development Bank
ADT  Average Daily Traffic
AE  Assistant Engineer
AQCs  Acceptance quality characteristics
BoQ  Bill of Quantities
BOT  Build Operate Transfer
CBR  California Bearing Ratio
CE  Chief Engineer
CEO  Chief Executive Officer
CREMA  Combined Rehabilitation and Maintenance Contract
CRF  Central Road Fund
CRRI  Central Road Research Institute
CSR  Civil Service Reforms
DAO  Divisional Account Officer
DASP  Diversified Agriculture Support Program
DBC  Dense Bitumen Concrete
DOT  Department of Transportation
DRDA  District Rural Development Authority
EE  Executive Engineer
ESALs  Equivalent Standard Axles
GO  Government Order
GOI  Government of India
GoUP  Government of Uttar Pradesh
GSDP  Gross State Domestic Product
HDM  Highway Design Model
HGV  Heavy Goods Vehicle
HQ  Head Quarter
HR  Human Resource
IBRD  International Bank for Reconstruction and Development
IDS  Institutional Development Strategy
IDSP  Institutional Development And Strengthening Plan
IRC  Indian Road Congress
IRI  International Roughness Index
ISAP  Institutional Strengthening Action Plan
JE  Junior Engineer
LCCs  Life-Cycle Costs
MDR  Major District Roads
MLA  Member of Legislative Assembly
MIS  Management Information System
MOST  Ministry of Surface Transport
MoSRTH  Ministry of Shipping, Road Transport & Highways
MoRTH  Ministry of Road Transport and Highways
MSS  Mixed Seal Surface
NABARD  National Bank of Agricultural and Rural Development
NITHE  National Institute for Training of Highway Engineers
NH  National Highway
NIT  Notice Inviting Tender
NHAi  National Highways Authority of India
O & M  Operation and Maintenance
PBC  Performance Based Contracting
PBC’s  Performance Based Contracts
BO  Bilan Operate Transfer
PCC  Project Coordinating Consultant
PCI  Pavement Condition Index
PCU  Passenger Car – equivalent Unit
PMMR  Performance based Contracting for the Management and Maintenance of Roads
PCC  Project Coordinating Consultant
PRC  Project Related Consultancy
PRM  Project Related Management
PRS  Performance Related Specifications
PWD  Publics Works Department
QRA  Quality Assurance
RES  Rural Engineering Services
RIDF  Rural Infrastructure Development Fund
RMMS  Road Maintenance Management Fund
ROW  Right of Way
RSBC  Semi Dense Bitumen Carpet
SRF  State Road Fund
SRP-II  State Road Project-II
SE  Superintending Engineer
SH  State Highway
SRP  State Road Project
SRP-II  State Road Project-II
TA  Technical Assistance
ToR  Terms of Reference
UP  Uttar Pradesh
UFRN  Uttar Pradesh Rajya Nirman Nigam
UPSBCC  Uttar Pradesh State Bridge Construction Corporation
UPSRCP  Uttar Pradesh State Road Transport Corporation
UPSRP  Uttar Pradesh State Road Project
UPSHA  Uttar Pradesh State Highway Authority
UNDP  United Nations Development Programme
UPORTC  Uttar Pradesh State Road Transport Corporation
UPSRP  Uttar Pradesh State Road Project
VOC  Vehicle Operating Cost
VR  Village Roads
WB  World Bank
WBM  Water Bound Macadam
PART 1: GUIDELINES FOR PERFORMANCE BASED CONTRACTING

1. BACKGROUND

One of the objectives of the technical assistance for implementation of Institutional Reforms in the Road Sector of Uttar Pradesh is to develop sound and efficient contracts and procurement processes in UP PWD. Under the description of services of IDS component the UP PWD has included an Implementation of performance-based works contracting as an action milestone.

The UP PWD has neither implemented nor developed any documents regarding performance based contracting on normal PWD works. However the UP Special Road Project wing (SRP) is in the process of implementing performance based contracting on road maintenance projects funded by the World Bank. UP SRP has not yet finalized these documents but proposes to form an SRP Cell with the specific purpose of developing bidding documents in accordance with the guidelines given in the World Bank’s Output and Performance based road contract documents.

Almost all the countries where performance based contracting is practiced follow the World Bank’s bidding documents with certain modifications to suit the specific country’s requirements. It is therefore deemed appropriate for the UP PWD to develop their own standard bidding documents as per World Bank’s sample bidding document for procurement of works and services under output and performance based road contracts (revision Oct 2006).

The purpose of this report is to provide an insight into performance based contracting and necessary guidelines for structuring the contract documents so as to implement performance based contracting in UP PWD.

2. INTRODUCTION

In India rehabilitation, resurfacing, reconstruction, or restoration works have, are typical of the majority of highway projects. These types of projects require a high-quality product and timely completion so as to minimize the negative impact to the public, such as road safety and traffic delays. Reducing the cost of road maintenance, improving road conditions, accelerating highway construction and minimizing the strain on resources, are the main concerns of all PWD's in India. The traditional system of awarding a project to the lowest responsive bidder is currently followed by the Ministry of Surface Transport GOI, NHAI, and several State PWD's. This traditional system, while providing a level playing field for contractors, has its limitations. For example, focusing on low bids sometimes leaves too little emphasis on product quality, a factor that has a significant impact on the long-term performance of the highway. The traditional approach is slow and does not favour a life cycle cost approach to projects.

The aforesaid facts and limited amount of resources for construction and maintenance accelerated the look for alternatives to traditional design-bid-build contracting in the construction industry. World over efforts were made to investigate innovative contracting methods.
3. TRADITIONAL CONSTRUCTION CONTRACTING

Under the traditional approach for road maintenance contracts, the Contractor is responsible for the execution of the works, which are normally defined by the Client (PWD), and is paid on the basis of unit prices for different work items, i.e., a contract based on “inputs” to the works. He is contracted to work and act in accordance with the Specification: the burden to ensure that the Contractor does in fact do so rests with the Supervising Engineer. One of the major drawbacks to this system is that, in many cases, the quality of work rests upon the shoulders of the Supervising Engineer whilst the Contractor's main concern is to complete the project within the agreed budget and time. This can lead to problems with quality and a desire on behalf of some Contractor's to sacrifice quality in order to meet their own constraints of budget and time. Admittedly some Contractor's are aware that one of their best marketing tools is a history embracing a reputation for good quality work and completion on time. But this comes with a cost.

Competitive bidding among contractors controls cost. Under the competitive bidding approach the general tendency is for a project to be awarded to the lowest responsive bidder. The traditional lowest responsive- bidder system is used throughout India. Most Contractors are comfortable with the procedure and understand its risks and rewards and consider it equitable. The basic intent of this approach is to minimize risk by defining all requirements of the project and eliminating most unknown conditions. Any errors and omissions in the plans, or unforeseen work, is the responsibility of the Road Agency.

Quality is sought through prescriptive plans and specifications coupled with oversight and inspection by the Supervising Engineer (PWD). Even though a short list of competent Contractors may be drawn up there is always a risk that the Contractor with the lowest responsive bid may not be able to produce work of the required quality. This inevitably leads to confrontation between Contractor and Supervising Engineer with the risk that the quality of the finished work may suffer.

3.1 LIMITATIONS OF THE TRADITIONAL CONTRACTING METHOD

Although this traditional approach has been the primary contracting method for the construction industry for quite some time, some limitations of the traditional method have been identified as follows:

- The system is slow and does not favour a life cycle cost approach to projects.
- The associated risks in terms of quality and maintenance are not the responsibility of the contractor, since the specifications are usually prescriptive and under the control of the Employer.
- There is little, if any, opportunity for contractor input into design and construction methods, and quality is often an issue of dispute.
- The PWD needs a large number of staff to conduct all of necessary functions of contract supervision.
• By adopting payment based on rates for work outputs, the contractor has an incentive to be efficient, but his objectives are not necessarily aligned with those of the client. For example, the long term objective of the client to minimize whole of life costs of pavement repairs is retained by the agency and is not transferred to a contractor who is merely being paid for repairing the defects as they occur – the contractor is not required to think about means of minimizing their recurrence.

3.2 REASONS FOR DEVELOPING INNOVATIVE CONTRACTING METHODS

The following are major potential reasons for developing and using innovative contracting methods for roads.

3.2.1. Reduction of Construction Time

A major incentive for implementation of innovative contracting methods is the reduction of construction time. One of the challenges that the road authorities face is the growing congestion on highways. The need to accelerate construction is becoming an important issue, especially in areas of high traffic congestion; the time overruns typically experienced in low-bid contracting have to be eliminated. The use of alternative contracting procedures and specifications to reduce construction time becomes a major consideration.

3.2.2. Reduction of Construction Cost

A major problem with the traditional method is the considerable cost and time overruns experienced over the allocated budget and schedule. It is recognized that some cost and time overruns are unavoidable, such as those due to unexpected and unforeseen events. However, overruns due to design plan or project management problems are avoidable because they should have reasonably been foreseen and prevented.

3.2.3. Applying Improved Technology and Techniques

A departure from the traditional contracting approach is needed to take advantage of advances in technology and techniques relating to construction materials, equipment, and methods. New and improved highway construction materials that result in long-lasting pavement can be implemented with innovative contracting mechanisms. The implementation of research results in both construction materials and methods that can be fully realized only through the use of specifications and contracting methods that depart from the traditional methods. These innovative techniques and materials improve quality, lead to reduced project duration, and normally result in lower life-cycle costs.

3.2.4. Deploying Contractor Innovation

The experiences and innovations by the construction industry can be implemented under innovative approaches. Specifications based on performance have been used as a solution to promote innovation by allowing the Contractor to control the materials and methods used.

Innovative contracting methods provide incentives to the Contractor to accept more risk and responsibility for providing a shorter project duration and lower overall costs.
3.2.5. Reducing impacts on the Public

Highway construction projects do have an impact on the public. Innovative contracting methods reduce construction time, which means shorter times driving through and around work zones enhancing safety and productivity. In addition, the use of technologies, materials, and techniques that reduce noise and other environmental impacts invariably reduce the impact of highway construction work on the public. Innovative contracting mechanisms offer the opportunity to reduce the negative impacts often associated with construction work.

4. PERFORMANCE- BASED CONTRACTING (PBC)

PBC is basically an alternative and innovative method of contracting. The U.S. Department of Transportation (DOT) defines PBC as:

"structuring the contract around the desired results rather than the method that should be used to accomplish these results".

The PBC means structuring all aspects of a project around the purpose of the work to be performed with the contract requirements set forth in clear, specific, and objective terms with measurable outcomes. PBC creates clearly defined performance measures, clearly defined outcomes and timetables, and allows for new and innovative methods.

Performance based contracting involves a significant shift away from more traditional approaches to the delivery of road maintenance by focusing on the key outcomes that the client wishes to achieve.

Under PBC’s the Contractor must inspect, plan, design, organise and deliver road maintenance services such that all assets are in a condition which are fit for purpose, and in accordance with specified asset condition standards, for a fixed lump sum price. For example, rather than being provided with a schedule of resurfacing lengths and locations over the term of the contract, the Contractor contracts to maintain a network at a defined level of roughness, rutting (or whatever other indicators the client considers important) for the entire duration of the contract.

Because performance-based contracts define success in terms of outcomes alone, they spark contractor innovation and dramatically improve quality. This arrangement creates opportunities for value engineering and improved efficiencies. Output and performance based road contracting is meant to establish a longer term Public – private partnership between the Contractor and the Government. Under PBC’s the Contractor’s focus is on the Integral Management of the Road assets over a given period.

The most common form of PBC’s in highway maintenance is total asset management, or “fence-to-fence” contracts. These contracts cover every part of the highway and include all maintenance works including managing the “total asset.” The contracts specify minimum performance standards and a desired end outcome. Payment is based on achievement at different milestones, rewarding Contractors for good, or exceptional, performance with bonus payments and penalizing them for poor performance with fines. Many of the risks are transferred to the
Contractor. Performance-based total asset management contracts are longer term than traditional contracts—typically five or more years with extension options at the end—which fosters a good relationship that will add to the value and quality of the work.

Nevertheless, if the outcomes become too complex to specify, the client may choose to include some output specified work in the contract. This is commonly done when:

- Significant rehabilitation work is required to bring the road to a standard that is acceptable. This might be specified to be completed within a given timeframe at the start of the contract, after which the performance standards will be adopted.
- The term of the contract is relatively short when compared to the life cycle of the asset. In this instance underlying minimum quantities of rehabilitation and resurfacing may be specified to ensure the long-term life of the asset is preserved.
- It is expected that the pilot contracts associated with this commission will be mixture of outcome and output based specifications.

PBC’s aim to align Client and road user objectives more closely with those of the Contractor defined by the contract as:

- Requiring the contractor to ensure the road network meets agreed performance criteria;
- Leaving the decision as to the work required to the contractor, thus promoting innovation;
- Giving the contractor a long term contract for a fixed lump sum, so that it is in the contractors interest to provide quality work at optimal cost;
- Giving the contractor responsibility for all assets in the road corridor, so that the client has one single point of contact for quality on the network. This avoids situations where a client, who might have various different contractors operating on the network, is unable to clearly allocate responsibility for defective work on the network.

4.1 PURPOSE OF PERFORMANCE STANDARDS

The goal of highway infrastructure is making highways safer, reducing construction-related congestion, and improving the quality. A performance standard can serve not only as a target but also as a benchmark against which success can be assessed. As such, these standards can provide a basis for gauging the value of specific tools, materials, and technologies, and construction or contracting practices, and the success, strengths, and weaknesses of individual construction projects or groups of projects.

A side benefit of performance standards is that they bring the construction contractor into the customer satisfaction equation. Rather than simply giving a contractor a set of specifications and waiting for the contractor to build a highway in an information vacuum, the owner agency focuses the contractor’s efforts on specific customer-related needs, such as minimal traffic disruption, speed of completion, smoothness level, quiet level of ride, or increased level of safety. Thus, the contractor and owner agency become a team aimed at satisfying the needs of the customer, rather than simply getting a road built.
4.2 SPECIFICATIONS VERSUS PERFORMANCE STANDARDS

While specifications define or provide a recipe for a specific final product, performance standards state what level of performance is expected for that product and then leave it up to the targeted organization to work out how to achieve it. In essence, performance standards represent a step beyond end-result specifications. The primary benefit is that an organization is allowed to use its expertise and experience to come up with innovative ways of obtaining the desired performance, rather than simply doing what has always been done before.

In highway construction, performance standards should not spell out a recipe for building a section of highway or a bridge, but rather give the contractor the levels of safety, quality, etc., and then allow the Contractor to use his own abilities to meet that challenge.

4.3 FORMULATION OF PERFORMANCE STANDARDS

A complete set of customer-focused performance standards would address smoothness, safety, congestion, and other aspects of quality. Moreover, an effective set of customer-focused performance standards would be founded on extensive input and participation from stakeholders throughout the highway community. Criteria that might be considered in formulating performance standards include:

- Availability of a standard test procedure for the metric
- Feasibility of applying the performance standard within the context of highway construction projects
- Ability of the work performed to influence the characteristic measured by the metric
- Clarity of the standard to the desired outcome improved safety, reduced construction-related congestion, or improved quality

To be truly effective, standards should be set at a level of performance well above average, but within the bounds of what has been achieved with current best practices and technologies. That is, they should require that Agencies and Contractors strive for excellence without setting a goal that cannot be achieved.

4.4 PERFORMANCE STANDARDS AND RESPONSE TIMES

Performance standards have to be clearly defined and objectively measurable. Typical performance standards are given below:

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

In addition to the performance standards there are other standards covering, for example, emergency response times and reporting procedures. These vary widely from one contract to another and from one country to another.

4.5 PERFORMANCE MONITORING AND PAYMENT PROCEDURES

Performance monitoring is the key to the success of PBC’s. Appropriate control procedures as well as penalties for non-compliance need to be well defined in the contract documents. To monitor the performance standards the designated inspectors are required to inspect the works making random checks to verify compliance as per the frequency specified in the contract. There may be four kinds of inspections as suggested below:

1. Monthly inspections covering a specified percentage (usually 10%) of the total length of the highway under contract. Selection of stretches of 1 km each is based on a random sample well defined in the contract;
2. Weekly inspections looking at 2% to 2.5% of the roads randomly selected;
3. Non-programmed inspections to respond to complaints by road users; and
4. Follow-up inspections to verify that appropriate action has been undertaken by the contractor to rectify non-compliance.

Experience underlines the importance of having a well-documented inventory of the road as well as daily records of activities undertaken by the Contractor. This helps to understand the specific behaviour of the roads and contributes to better preventive maintenance. The Inspectors and Contractor's staff will go through a valuable phase of learning and adaptation to arrive at an effective control system.

A very important role is played by the active participation and control of the road user. Each toll station should be mandated to maintain a complaint and suggestions book with road users encouraged to report incidents. This should help to improve road conditions.

Payments to the Contractor are to be based on the results of the monthly inspections. A percentage of compliance is calculated based on a formula using the results of each individual performance standard as input data. Full payment will only be made on 100% compliance. Penalties will be applied if the contractor does not rectify established deficiencies within a certain time limit.

For the Contractor to manage the contract properly and the PWD to monitor same, it is vital that the Contractor has a proper management and quality control system in place. A specific provision in this respect should be included in the contracts. Part of the obligations of the Contractor is to keep records of his inspections, quality control procedures and works undertaken. It is especially important to monitor and make necessary adjustments to pilot projects so as to gain experience for future contracts.
4.6 PERFORMANCE BASED CONTRACTING TECHNIQUES

Under PBC's key success factors are identified. The Contractor's performance on these key success factors is ensured through rewards and penalties. The success factors depend on the nature of the project and even though multiple performance contracting techniques have been developed for different kinds of projects, all these techniques are centred on the fundamental premises stated below:

1. Contracts which focus on inputs and include in the contract specifications how a job is to be performed and with what inputs, or
2. The type of contracts, which focus on tangible outcomes.

Four innovative contracting methods have emerged as the primary alternatives to the traditional contracting method for the road network:

- Warranty,
- Design-build,
- Cost-plus-time (A+B) Bidding,
- Lane rental.

These contracting methods are not mutually exclusive and can be combined in a single project. Their main thrust is to minimise construction time and cost, to improve quality (either by providing specifications for quality control and inspection, or warranties), and to transfer some of the risk from the PWD to the contractor.

Under traditional contracts the Contractors accept limited risk in which the PWD's include detailed specifications regarding constructions methods and materials. PBC's address the issues of risk transfer and Contractor liability in highway construction contracts. In such contracts the PWD specifies the criteria for performance while providing the Contractor with more freedom and responsibility to meet that criteria.

4.7 BENEFICIARIES OF PERFORMANCE BASED CONTRACTING

The beneficiaries of PBC's are the road users, the PWD's, and the Contractors. In a wider sense, future generations will be able to benefit from a better preservation of past investments in roads. The beneficiaries are:

- Road users will know the Service Level they can expect in return for the payments they make for the use of the infrastructure (tolls, tariffs, user fees, taxes, etc.).
- The PWD's should benefit by obtaining better overall road conditions for the same levels of expenditure.
- For Contractors the new type of contracts should open up new business opportunities, in which longer contract periods provide a more stable business environment, and for the establishment of true Public-Private Partnership relations.
• However, it may be the future generations who will perhaps benefit most, since they will not have to pay for the reconstruction of roads lost through of a lack of maintenance, as is the case today.

5. PERFORMANCE BASED CONTRACTING IN THE INDIAN CONTEXT

PBC’s in India are at an early stage of development, especially in the field of highway construction and maintenance.

NHAI are beginning to explore the potential of developing and using performance-outcome-based contracting in which the Contractor is responsible for the condition of the roadway over the long term. Some of the contracting approaches used with these long-term performance specifications include Design-Build-Operate and maintain – Transfer.

During the last two years NHAI and some of the State Governments have successfully switched to a BOT/Annuity concept contracts, which are an improvised form of PBC’s. This BOT/Annuity based contracting system mostly involves integrated works comprising both the rehabilitation and subsequent operation and recurrent maintenance of road networks.

The concept of PBC’s for design- build - operation and maintenance of National Highways is being adopted by the NHAI for the following reasons:

1. Non-availability of personnel within the NHAI for measuring the vast quantities of activities involved in the more traditional maintenance contracts, and for monitoring performance standards using inputs indicators such as materials, equipment and labour
2. Need to focus on cutting the cost of road maintenance while at the same time improving road conditions
3. The frequency of claims arising from the traditional contracts, and the corresponding time-consuming efforts wasted in justifying such claims, looking for additional budget allocations, and finally drawing up contract amendments;
4. The need to focus more on customer's satisfaction, seeking to identify the outcomes, products, or services that the road users expect to be delivered, and to monitor and pay for those services on the basis of customer-based performance indicators; and
5. The need to shift greater responsibility to Contractors throughout the entire contract period as well as to stimulate and profit from their innovative capacity.

PWD’s with a long tradition of contracting out routine maintenance on their road network are presently confronted with the problems of reductions in staffing and budgets to manage, monitor, and supervise such maintenance contracts. A more simplified, rapid, and less cumbersome approach, especially for a PWD, would be to implement pilot performance contracts using Total Quality Management (TQM), a new approach to the art of management that seeks to improve product quality and increase customer satisfaction restructuring traditional management practices. PWD staff are generally preoccupied with maintenance activities whereas the road users are interested in the outcome of what is done, and not how it is done or measured.
PBC's currently in operation (mainly on NH) are an integrated system of widening, improvement, rehabilitation, operation and maintenance contracts under annuity schemes covering both the paving and future maintenance of National Highways.

Performance based contracting has been tried by way of implementing pilot projects in the State of Karnataka, Kerala and Andhra Pradesh. A number of Indian contracts are already based on specific performance parameters. NHAI has entered into contracts on annuity scheme projects for the construction of quite a few National Highways in India such as:

- Jaipur-Kishangarh, Panagarh-Palsit; and
- Tambaram-Tindivanam sections of National Highways

The annuity contract is a build-finance-operate contract, in which the Contractor is also given the option to review and modify the project design. The annuity amount comprises construction costs, operation and maintenance costs, finance charges, risk premium, and the Contractor’s return of which the construction and operation and maintenance costs are the most significant. The main performance parameter is the life cycle cost of the project and accordingly the selection criteria is the lowest annuity amount payable to the Contractor. In addition to minimizing the life cycle cost the contract also specifies a minimum lane availability to ensure that maintenance is not at the cost of road users. The performance is enforced through incentives and penalties stated in contract.

Another pertinent example of performance based contracting is the Design-Build-Operate contract awarded by Delhi Jal Board for augmenting its water treatment and distribution systems. The contract specified that the Contractor would have the single-point responsibility for designing, constructing, operating and periodically maintaining the plant. The evaluation criteria ensured that all parameters that have a bearing on the plant’s long-term life cycle cost were identified and factored in. The payment mechanism comprised two components: a predetermined lump sum component towards construction, and fixed operation and maintenance costs including a variable component towards the cost of consumables and other variable expenses. The following incentives and penalties were built into the contract:

<table>
<thead>
<tr>
<th>Performance requirement</th>
<th>Penalties</th>
<th>Incentives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality and timeliness in construction</td>
<td>1. Liquidated damages</td>
<td>Performance bonus</td>
</tr>
<tr>
<td></td>
<td>2. Retention money</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Performance guarantee</td>
<td></td>
</tr>
<tr>
<td>Output (quality as well as quantity) during the O &amp; M period</td>
<td>Liquidated damages</td>
<td>N/A</td>
</tr>
<tr>
<td>Ability to consistently meet performance standards either immediately after construction or during operations</td>
<td>Termination of the contract and Liquidated damages</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Internationally more than 50% of all contracts have performance parameters specified and increasingly PBC's will replace traditional contracting methods in India also. This would imply that for continued growth in the construction industry, organisations need to recognise and start building their capabilities to undertake projects based on PBC.

Already in existence are contracting techniques designed to optimize performance under various parameters such as project design, construction time, operations and maintenance costs, and overall life cycle cost. The annuity road projects of NHAI and design-build-operate water projects are prime examples of customized PBCs in India.

6. PERFORMANCE-BASED MANAGEMENT AND MAINTENANCE OF ROADS (PMMR)

The NHAI and State Governments in India are seeking to increase the efficiency and effectiveness with which the management and maintenance of the nation's road network is carried out. This is motivated by the recognition that the road network constitutes the single largest asset owned by the Government, and that a less-than-optimal system for the management and maintenance of that asset generally results in huge losses for the national economy. This occurs not only in the form of road deterioration and reductions in road asset value, but even more so in the form of increased vehicles operation costs which have to be borne by road users and which reduce the competitiveness of India in an increasingly global economy.

NHAI and some of the State Governments have combined well-known and traditional methods of road rehabilitation and reconstruction with Performance-based contracting for the Management and Maintenance of Roads (PMMR) for the management and maintenance of that part of the road network which is still in relatively good condition. This should avoid a premature deterioration of road assets in general, and assure that road users can count on a level of service, which is adequate for their needs, while keeping the cost down for providing those service levels.

The objective of PBC's for PMMR is to increase the efficiency and effectiveness of road maintenance operations. This should ensure that the physical condition of the roads under contract are in good to fair condition (typically with roughness of less than 4 IRI) and remain substantially in that condition for the entire period of the contract. This is to be achieved through routine maintenance activities alone, without any major strengthening or rehabilitation. This type of contract significantly expands the role of the private sector from the simple execution of works to the management and conservation of the road asset.

Salient Features for contract under Performance-based Management and Maintenance of Roads (PMMR) are given in Annexure No. 1.
7. COMBINED REHABILITATION AND MAINTENANCE CONTRACT: (THE CREMA / HYBRID CONTRACT)

The CREMA (Contrato de Recuperación y Mantenimiento) is a combined Rehabilitation and Maintenance Contract that requires the Contractor to rehabilitate and subsequently maintain a sub-network of roads under a lump sum contract for a specified period. The CREMA contracts are also called as Hybrid Performance based Contracts.

The CREMA system applies to a paved sub-network, which needs to be rehabilitated over a part of its length, and subsequently maintained over the whole of its length. Rehabilitation works include either resurfacing with slurry seals and surface dressing, or overlays with asphalt concrete, or reconstruction of the base and wearing course. These works are carried out during the first year of the contract while maintenance activities (patching potholes, cleaning drainage system, etc.) are undertaken throughout the contract period.

The network is defined by the Road Agency and comprises contiguous, or area-specific sections of roads, of a specified total length. The contract specifies the sections that require rehabilitation as well as the minimum solution (i.e. overlay thickness) required to ensure a positive Net Present Value for the investment at a certain discount rate. The contract is awarded to the lowest evaluated bidder. After the award the Contractor is required to carry out a detailed engineering design and is free to propose, on the basis of his own risk assessment, any rehabilitation solution above the minimum threshold level defined in the Contract.

Salient features for the CREMA concept are described in Annexure No. 2.

8. SPECIFICATIONS

8.1 HIGHWAY CONSTRUCTION SPECIFICATIONS

The characteristic common to all the innovative contracting methods is that the Contractor must have the freedom to decide the best method and material for the project with the Road Authority providing direction on the performance, schedule, and cost.

The United States Transportation Research Board (TRB) has published definitions of the various specification types that are applicable to the construction industry. Some of the relevant definitions and their usage are given below.

8.1.1. Performance-Related Specifications

Performance-related specifications (PRS) describe the desired levels of key materials and construction quality characteristics that have been found to correlate with fundamental engineering properties that predict performance through theoretical models. These measured acceptance quality characteristics (AQC) – for example, air voids in asphaltic pavements and strength of concrete cores – are amenable to acceptance testing at the time of construction. True performance-related specifications not only describe the desired levels of these quality
characteristics, but also employ the quantified relationships containing the characteristics to predict subsequent pavement performance.

This link between measured AQC's and future life-cycle costs (LCCs) decides the Contractor pay adjustments based on the construction quality. The State Highway Authorities define the target level of quality for which it is willing to pay as 100 percent of the bid price. Prior to bidding, the Contractor is made fully aware of this desired level of quality and the price adjustments to be applied when this level is not obtained. Highway Authorities are moving towards performance-related specifications (PRS) that specify quality in terms of desired performance over the long term.

8.1.2. Performance-Outcome-Based Specifications

Performance-outcome-based specifications describe how the finished product should perform over time. These specifications can range from true performance-based-outcome specifications, in which the Road Agency provides more freedom to the Contractor in many aspects of the project while holding the Contractor to a set of performance goals and outcomes, to a more restrictive type of performance specification, which holds the Contractor liable only for the performance of some components of the project and limits the Contractor's freedom.

For highways performance is typically described in terms of changes in physical condition of the surface and its response to load, or in terms of the cumulative traffic required to bring the pavement to a condition defined as “failure.” The most common mode of performance specifications used in the highway construction industry is warranty/guarantee clauses. Other than the warranty/guarantee type, performance specifications have not been used significantly for major highway pavement components (e.g., sub-grades, bases, riding surfaces) because there have not been appropriate non-destructive tests to measure long-term performance immediately after construction. Tests are specified for some products such as highway lighting, electrical components, and joint sealant materials for which there are tests of performance that can be conducted rapidly.

8.2 DEVELOPMENT OF PERFORMANCE BASED SPECIFICATIONS

Performance Based Specifications focus on outcomes rather than processes – what services and goods are required, not how to produce same. The goal is in developing a specification that allows bidders to bring their individual expertise, creativity, and resources to the bid process without encumbering them with predetermined methods or detailed processes. Specifications developed from this point of view increase alternatives, attract more potential bidders and foster better competition.

A Performance Based Specification consists of several key steps:

- Defining functional requirements
- Determining performance acceptability and compliance
- Outlining incentives, remedies, and penalties
8.2.1. Requirements

Requirement must focus on the qualitative. The specification must ensure that the prospective bidder understands the bid request. If the bidder does not understand, then the process of evaluating a bid on common standards is difficult. An example of a clearly specified request would be “the contractor must perform preventive maintenance services”

Next, the requirements must be verifiable and measurable. It must be possible to determine whether the product or service will perform as required. For example, if a particular strength of material is requested that strength must be verified through analysis, demonstration or testing to support the vendor’s claim.

Using the earlier example, “the contractor must perform preventive maintenance services” and adding “with 80% compliancy” defines the level of service required. The 80% is definable and measurable. Performance standards state such things as response times, deadlines, cost controls, error rates, etc. Well written requirements describe how a product or service can link, or interface with, existing products or services to achieve certain economies of scale.

8.2.2. Incentives

Incentives should be used only when they may be expected to produce superior performance. This is especially true in the case of service contracts where the successful Contractor can change processes and workflows to generate a more favourable outcome. Incentives should be applied at a high level and not for a certain task. Incentives must be achievable, challenging, and attractive to the Contractor.

Incentive can be negative. If negative incentives or remedies are employed, they should closely match the value cost. The bid document must state not only how much the Contractor can make through positive incentives, but also how much will be deducted for added to the sentence on performance short falls.

8.2.3. Quality Assurance

A section of the bid document deals with Quality Assurance (QA). A QA plan defines what action the end user will take to ensure that contract terms and conditions are met. QA can be monitored in periodically scheduled reviews with the Contractor.

The QA plan consists of a progress schedule and a clearly stated “report card”. The Contractor must understand what information to include in this report. Terms and conditions must be precisely defined with quality and quantity measures, and on-time standards, not specific steps or processes, emphasised.

8.2.4. Contract Management and Conflict Resolution

Although not part of the bid document, two final elements are important to the Performance – Based Specification process: Contract management and conflict resolution. It is crucial that all parties understand how these two functions will be implemented.
Conflict resolution traditionally is resolved in costly and time consuming litigation. Many potential conflicts can be resolved in early contract stages in a “kick off” meeting in which all parties express expectations, known obstacles, goals, and objectives. Communication links should be established that will foster a more cooperative method of resolving problems.

8.2.5. Acquire the Best at Least Cost

Performance Based Specifications offer an opportunity to acquire the best product or service at least cost, leading to better competition and shifting some performance risk to the Contractor. The process allows incorporating best practices in building the specifications and provides the Contractor with the latitude to determine work process and product improvements with more responsibility for quality. It permits the Contractor to utilize the best practices.

9. PROCUREMENT OF WORKS AND SERVICES

For procurement of works under output-and performance based road contracts a customised bidding document is an essential requirement. Ideally the structure of bidding document should comprise of following:

1. Biddings Procedure
2. Work Requirements
3. Conditions of contract and contract forms

The various tasks that should be followed for procurement of works are dealt in detail under part - 2 of this report – Design and Management of Performance Based Contracts.

10. CONCLUSION AND RECOMMENDATIONS

With a properly structured agreement in place, the burden and expense of maintenance can be shifted to a private provider. Experience shows that outsourcing can lead to cost savings, quality improvements, and long-term warranties. With many Governments facing continuing financial challenges and aging infrastructure, the outsourcing of road and highway maintenance will continue to be a viable option for high quality and cost-effective services.

A contracting approach that departs from the traditional design-bid-build approach offers benefits in terms of cost, time, and quality. The degree of benefits, however, depends on several factors, including the type and nature of the project and the type or combination of types of innovative contracting approaches employed.

The primary reasons for the limited usage of these methods are given as follows:

1. Lack of experience in implementing long-term maintenance contracts in projects
2. Extra work involved in developing specifications for such projects
3. Lack of research and evaluation comparing the costs of in-house maintenance and operation compared to outsourcing highway construction and maintenance.

4. Road authorities (PWD) are not sure what type of projects benefit most from performance-based contracting.

5. NHAI and PWD have concerns about the ability of the contractors to manage the highway long-term.

6. Bonding agencies are concerned about the risks involved with such long-term warranties.

Most of the Performance Contracts that have been let recently are still in a pilot stage, so only preliminary conclusions can be drawn at this stage. The following recommendations are mainly based on a review of the experience gained with the Performance Contracts the World over:

- Securing finance on a long-term basis is critical to success. Contracts should be for as long a term as possible to promote innovation, ensure ownership, and minimise undesirable short-term thinking. Performance Contracts with a duration between 5 and 10 years are preferred. It is important to secure financing for the entire contract period before starting such a contract. Whenever circumstances permit, Performance Contracts should be of longer period and include periodic maintenance in order to maximize the potential benefits. The longer the contract the greater is the incentive for the contractor to try-out and apply new technologies and to optimize resource allocation.

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

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

- Well-qualified Contractors and Inspectors are key to the success of Performance Contracts. A capable contracting industry must be available, and be ready to take on the responsibilities of long-term asset management (often supported by a specialist consulting industry to assist with the asset management element); training programs should be conducted for small-scale enterprises and inspectors. Equally, traditional Contractors require training in modern management techniques and the application of new maintenance procedures and technologies.
• Proper performance monitoring and strict application of penalties for non-compliance have proven to be critical success factors. In order to avoid deficiencies in achieving performance standards the PWD should properly monitor the performance of the Contractor and apply proper penalties for non-compliance.

• Contracts should aim to be comprehensive in their coverage of the different assets (e.g. signs, pavements, culverts etc).

• A positive approach to cooperation and partnership between the Client and Contractor is required, as performance requirements might still be evolving and developing as experience is gained – the effort required in ensuring that there is a true sense of partnership should not be underestimated;

• A rigorous review of performance standards for all the assets is required, to ensure they are achievable and meet client objectives. Successful standards are transparent and not overly complicated, and where it becomes difficult to specify outcomes / standards, the contract might revert to output based specifications, particularly when addressing work backlogs

• A thorough inventory of all assets is required (quantified and objective) so that Contractors can price the work;

• The procurement process must be transparent and comprehensive in terms of ensuring that bidders are aware of their obligations under the contract;

• Risks must be clearly identified, equitably shared, and defined so that each party is aware of its responsibilities under the contract;

• To ensure competitive prices the industry must be aware of the long-term potential market for such work. Also, given the significant cost of tendering for such work, contracts must be of a significant value;

• Clients must have a capacity to manage the contract as auditors, and not expect to interfere with management decisions of the Contractor on the network;

• Contractors must be able to establish clear systems for compliance monitoring.

In summary PBC’s demand a significant change in the culture of both the contracting industries and the Road authorities. It is important that the industry is included at an early stage in the introduction of this new contracting philosophy and is consulted as the format is adapted to meet needs of the region where the project is located.
PART 2: DESIGN AND MANAGEMENT OF PERFORMANCE BASED CONTRACTS (PBC'S)

11. BACKGROUND

Those countries which have introduced Performance Based Contracts (PBC's) have done so gradually, starting with one or two pilot projects in order to gain experience with the new contract arrangements. Before embarking on any pilot scheme it is necessary to analyse the legal and financial feasibility of PBC's. One of the most important legal aspects is the maximum contract period allowed by law. If the maximum duration of a contract is restricted to a specified period it will be necessary to amend the laws in order to accommodate long-term contracts as financing has to be secured for the entire duration of the contract.

12. STRATEGY FOR THE DESIGN OF A PBC

12.1 DETERMINATION OF ROAD AGENCY’S NEEDS

The first step towards the adoption of PBC's is to determine the needs of the PWD. This involves answering questions including what services and outputs need to be provided. These services and tasks must be broken down into various tasks for developing bidding documents.

12.2 PREPARATORY ENGINEERING WORKS

Although the design of the works and services to be carried out are under the responsibility of the Contractor, this type of procurement requires good preparatory engineering work. It is necessary to prepare comprehensive information on the actual condition of the roads covered by the contract. In this respect it is important to define the road network to be contracted, to prepare the inventory of the assets involved, and to determine the condition of assets.

12.3 REHABILITATION WORKS

If rehabilitation works are required, it is necessary to define the likely maintenance and possible Rehabilitation Works. It will also be necessary to define the level of quality (or standard) to be achieved by the Contractor for delivery and completion during the contract. If improvement works are sought, a well-designed bill of quantities defining specific outputs for bidders to price and, later on, allow measurement and payment of the Contractor, is of paramount importance.

Another important area requiring sound engineering advice is to define if the Rehabilitation Works should be included in the contract or be carried out in advance under a separate "standard" civil works contract. This decision depends in each case on the risks that the Borrower (and his advisor) understands as possible to be administered cost-effectively by the Contractor. In general, if those initial works represent more than 40-50% of the contract value, the risks may be too high and an initial separate contract may be warranted. However, if the PWD wants to have Rehabilitation Works based on a pre-defined design and use this document to connect it to future maintenance by the same Contractor, the documents need to be adapted. In this case, the bill of quantities for Rehabilitation Works should be modified to become similar to those for
emergency works and the measurement and payment clauses should be modified for an “input” type contract.

12.4 EMERGENCY WORKS

Emergency Works, although impossible to quantify in advance, will certainly be necessary. To allow bidders to offer prices for Emergency Works, a unit price bill of quantities (similar for civil works under unit prices) with quantity estimates should be prepared for bidders to price for bid evaluation purposes. Later on, these unit prices and real measured volumes of Emergency Works executed will be used for payments.

12.5 PERFORMANCE STANDARDS

After carrying out data collection of the project roads and identifying the maintenance, rehabilitations and emergency work needs, the Road agency should select and define performance requirement for each task/service along with performance standards and quality levels. Having selected and defined the performance standards the next step is to select and define the methods of measurements of performance standards.

12.6 PRELIMINARY COST ESTIMATES

Another important aspect in respect of design of PBC is to determine the cost of works. It is therefore of the utmost necessary to prepare a preliminary cost estimates.

12.7 PRE-QUALIFICATION OF CONTRACTORS

When Rehabilitation Works and Improvement Works are not specifically required in the bidding documents, it is expected that in order to comply with the contract, the Contractor will most likely have to carry out different types of works, including some small initial rehabilitation and improvements, routine maintenance activities and periodic maintenance works. The definition of the exact nature of the works, their timing, their costing and their implementation is left to the judgment of the Contractor. This means that his capacity must be above the usual capacity of a traditional civil works contractor. In fact, an essential attribute is the capacity to manage roads, while the actual physical execution may either be carried out by the Contractor himself, or by different specialized firms participating in a Joint Venture with the main contractor, or under subcontracts. Joint Ventures may include Engineering firms and medium, small and even micro-enterprises. In order to ensure that only qualified bidders participate in the bidding process, it is necessary to follow a well-designed pre-qualification process.

For such types of contracts the bidding documents, are to be prepared to suit the special nature of performance contracting system. Since Performance Contracts are new for road administrations and contractors alike, close cooperation between both parties is vital for success. Both sides have to be comfortable with the contractual arrangement and understand the risks involved. Especially in the case of pilot schemes the qualification of the contractor is a major factor besides the overall price. Therefore, the Contractor who offers the lowest price does not necessarily win the contract.
12.8 CONTRACT PRICE

Performance Contracts essentially are fixed price contracts. But they often do contain a schedule of prices for emergency works. If sections of the road in question are in poor condition, the contract should include the rehabilitation of these sections as well. In this case rehabilitation works may be carried out in the "traditional" form, with official design, and paid on the basis of unit prices. Or alternatively, final design of rehabilitation works can be left to the Contractor and payment for these works can be included in the lump sum contract price.

(i) An approach can be adopted whereby a fixed percentage of the lump sum amount may be paid in three to four instalments during the first year (rehabilitation period). And balance of lump sum amount may be paid in equal monthly instalments in the balance period of the contract.

(ii) To include initial rehabilitation works in the Performance Contracts has two main advantages: first, it gives the contractor incentives to perform well on the rehabilitation works to avoid premature repairs which would increase maintenance cost, and second, it insures that maintenance will start immediately after the rehabilitation works have been completed.

12.9 INCENTIVE / PENALTIES

PBC incentive-based contracts shift the risk to the Contractor, who is rewarded for productivity improvement and penalized for poor performance or rising costs.

13. ACTIVITIES AND TASKS FOR DESIGN AND MANAGEMENT OF PERFORMANCE BASED CONTRACTS

For acquisition of a pilot performance-based contract the entire exercise is to be broken down into the following parts:

A. Establish an integrated solutions team
B. Development of Contract strategy.
C. Review of the adequacy of current information and collection of any additional condition data deemed necessary for the management of the pilot contracts.
D. Development of contract documentation.
E. Management of Procurement:
F. Manage performance: Compliance monitoring and the management of the contracts
G. Final report and recommendations

The aforesaid activities are further sub divided into tasks stated hereunder:
13.1 PART A - ESTABLISH INTEGRATED SOLUTION TEAM

For design and Management of Pilot PBC's the PWD should establish and implement an appropriate regime for managing the contracts, and for identifying future developments based on lessons learned. The PWD should establish a separate team for design and management of PBC's.

13.2 PART B - DEVELOPMENT OF CONTRACT STRATEGY

13.2.1. Selection of Road Sections to be included under PBC's

Normally Selection of roads to be included in PBC's will be based on the following criteria:

a) Present condition of the road sections, in order to avoid road sections which require large-scale rehabilitation works before they can be maintained,
b) Traffic volume and growth rate
c) Resources available to finance PB contracts, and
d) Possibility to group and package road sections, avoiding too broad a scattering of separate sections over a large geographical area.

13.2.2. Description / Definition of Service Level for Roads Included in Contracts

The Road agency is to define the adequate service levels/maintenance standards for each road to be included in PBC contracts. This exercise will be based on:

a) Existing data available with the Road agency:
b) Information to be collected during field visits
c) Analysis of typical road uses and road users needs for each road, including formal consultations and informal discussions with road users and local communities.
d) Establishing a link between road user needs and the required service level class, and
e) Affordability, or the availability of sustainable funding levels

13.2.3. Evaluation of Contractor’s Capacity to Undertake and Manage the Works

The review shall consider contracting industry and also look to awaken the industry to the opportunities presented by PBC's.

Given the nature of the PBC’s the capacity of Contractors must go beyond the mere execution of works and include the capacity to design and plan the required actions and interventions in order to maintain the contractually agreed service levels. Therefore it is necessary to carry out a brief assessment of the private-sector entrepreneurs active in the State /country and sub-region, in order to evaluate their technical, managerial and financial capacity. This shall not be limited to works contractors, but also include other firms, which may have the technical, financial, and management capacity to carry out a PBC, with the use of sub-contractors to carry out physical works. The purpose of this task is:
a. To get an idea of the potential bidders and their capacity,
b. To have a basis for defining pre-qualification criteria for bidders,
c. To identify weaknesses of likely bidders and ways to mitigate risks linked to those weaknesses.

A detailed assessment of technical (specifically, design and long term maintenance planning capability), financial and managerial capacity of contractors is required to be undertaken to identify:

a. The number of potential bidders for such works
b. A basis for pre-qualification of bidders
c. Specific issues of risks which will require mitigation when developing the contract document, and
d. The value of contract that will best fit local capacity.

13.2.4. Grouping and packaging of road sections by contract

Based on the capabilities of the Contractors identified as above, and the list of identified road sections, an appropriate size for PBC's, in terms of the number of road-km to be included in each contract, and the total number of contracts to be let, shall be decided.

The packaging should further attempt to maximize the efficiency of contractors, by avoiding as much as possible geographical dispersion of road sections, and promoting some degree of specialization for different road types (for example paved/unpaved, or high/low traffic).

13.2.5. Development of Contract Format

A detailed study is to be conducted to develop an appropriate format for the Pilot PBD's. It is important that the proposed format matches the industry's ability to undertake the works and maximizes the potential for success. It is necessary to give careful consideration to the appropriate mix of outcome and output elements in the contract, noting that the objective is to introduce as many performance based elements as is practicable.

A concise report shall be prepared outlining the options considered, the reasons for their recommendations, and the cost implications. Issues to be addressed in the study include:

1. The extent of the assets, in addition to the pavement that are to be maintained under the contract. For Example, in addition to the pavements should the contract include the management and maintenance of all:
   - Signage?
   - Delineation?
   - Lighting?
   - Vegetation?
   - Rest areas?
• Slopes?
• Retaining structures?
• Drainage works?
• Bridge structures? (Type of maintenance included should be stated i.e. routine, periodic, emergency or rehabilitation)

2. The risk profile to be transferred to the contractor in the event of:
   • Storm Damage
   • Bridge damage
   • New Roadside developments (Removal of encroachment can have a major impact on the amount of sediment build-up in drainage structures.
   • Capital/Improvement works being undertaken by other contractor or under the proposed PB contract.
   • Who will undertake the Utility operations within ROW and its impact?
   • Impact of Legislation changes (e.g. Load limits)
   • Change in Traffic volume
   • Environmental Compliance

The boundary between policing/enforcement and the operational requirements also needs careful consideration (e.g. enforcement of load limits).

13.2.6. The Proposed Performance Criteria

The criteria should be comprehensive cover all aspects of contract and take account of the fact that different sub areas within the contract area might require different benchmark values. Criteria developed at three levels and defined in terms of:

13.2.6.1 Long Term Asset Performance Measures, which can be expressed in terms such as:

• Roughness profiles
• Rutting profiles
• Skid resistance profiles
• Strength profiles
• Vegetation Control envelope
• The retro-reflectivity of road signs and markings
• Cross profiles
• Shoulders
13.2.6.2 **Operational Performance Measures**, which can be expressed in terms such as:

- Availability of each lane –Km for use by traffic
- Response times to rectify defects that compromise the safety of road users.
- Attendance of Road accidents
- The extent of repairs permissible before a more extensive periodic maintenance treatment is required.
- Drainage off the pavement

13.2.6.3 **Management Performance Measures**, which define the information the PWD requires to govern the asset both during the term of the contract, and to facilitate the next tender round. Requirements should include:

- Delivery of regular monthly reports to PWD
- Inventory updates and other data sharing
- Maintenance history

To avoid ambiguity, all performance measures must be clearly defined and objectively measurable.

13.2.7. **The Minimum Engineering Standards**

Appropriate minimum engineering standards for both routine and periodic activities should also be studied and defined in a manner that is consistent with the intent of the procurement model. The aim is to minimize total cost to the State of the ownership of the asset, including the long-term cost of preserving the roads as well as minimizing the cost to the road user, whilst at the same time encouraging the Contractor to introduce innovation.

13.2.8. **Quality Frame work**

The proposed quality framework shall be used for ensuring compliance of the works, including the penalty regime that will prevail in the event of any non-compliance by the Contractor.

13.2.9. **Bid evaluation procedures**

A transparent bid evaluation procedure should be developed that meets the objectives of obtaining the best value for money over the term of contract, whilst at the same time conforming to any legislative requirements that govern the letting of contracts by the PWD.

13.2.10. **Industry Consultation Workshop**

In each of the pilot areas, conduct a one-day workshop with representatives from the industry to outline the draft contract strategy and gain feedback from them before producing the final report and submitting it for approval from the competent authority.
13.2.11. Contract Strategy Report

At the end of this phase a technical report should be prepared. This report should contain the recommendations; the reasons for them, and the likely cost implications. In order to implement the pilot projects of PBMC's smoothly and effectively, a clear understanding of roles by each party is essential. These shall be clearly spelt out in the report.

13.3 PART C - REVIEW OF THE ADEQUACY OF CURRENT INFORMATION AND COLLECTION OF ANY ADDITIONAL CONDITION DATA DEEMED NECESSARY FOR THE MANAGEMENT OF THE PILOT CONTRACTS

Section 3.3 (Part C) may be carried out concurrently with Section 3.2 (Part B)

13.3.1. Review of the Adequacy of Current Information

The information on the asset available with PWD should be clearly stated.

The data available with PWD may relate to following:

- Roughness data in terms of IRI
- Benkelman Bean Deflection data
- Traffic Volume and its composition
- Pavement Condition data
- Road inventory
- Work history

The aforesaid data shall be reviewed with regard to its adequacy for the implementation and management of a PBC. While the information available may undoubtedly be of value for the management of their overall network, there are questions as to its adequacy to manage at the detailed level required in a PBC contract.

After reviewing the available data a detailed report shall outline the review findings and identify all data omissions and a strategy for the data collection.

13.3.2. Collection of roughness, rutting and texture data

The roughness, rutting, and texture data currently available with the PWD may not be suitable for the management of a PBC contract. Therefore it is necessary to conduct roughness surveys and pavement condition surveys on the pilot project roads.

13.3.3. Collection of Additional Data

It is expected that some additional surveys and visual pavement condition surveys of each network will be required. The PWD should establish appropriate quality procedures for data collection and reporting of the data.
13.3.4 Video recording of network

A video record of each network should be produced immediately prior to the commencement of the contracts. The purpose of the video is to record the state of the road corridor at the time of handover, so that any future disputes about the presence / condition of certain assets (signs, road markings, roadside developments) can be quickly resolved.

The videos will be stored as digital images and referenced against the location on the network by chainage and / or GPS co-ordinates. The locations should be displayed on the video images and linked to the frame numbers.

The PWD should conduct the video surveys, driving in each direction on all roads and should Road agency will maintain the copies of the video for their records and future reference. The Contractors shall also be provided a copy for the duration of their commission.

13.3.5 Data Report

At the completion of the aforesaid tasks a report should be prepared on the data and its implications for the management of the contract. The data should be stored in a database, which can be distributed to the Contractors, and reported in a manner suitable for inclusion in the contract documents.

13.4 PART D - DEVELOPMENT OF CONTRACT DOCUMENTATION

Describe the problem that needs solving.

13.4.1 Development of Long Term Programme of Work

Based on the outcomes of the tasks of Parts B and C describe all those problems that need solving, and develop a long term programme of work which will be used as the basis of preparing the Engineer's estimate for the contract. For each asset type develop a rigorous analysis of needs based on a life-cycle costing approach to identify the projected work requirements.

A careful consideration should be given to those projects required to bring the pilot areas up to the agreed standard and which shall be specified for completion in the first year of the contract (see Para 13.4.2 below) to the level of periodic maintenance that is likely to be required in subsequent years.

An analysis is to be undertaken to estimate the long-term pavement and surfacing requirements, using relationships such as those contained in the HDM model or a suitable alternative. Whichever approach is used, the PWD should ensure that the modelling relationships are properly calibrated, and used to suit the objectives of the contract.

For emergency work, identify the extent and nature of typical expenditure on such items for the pilot areas.

13.4.2 Detailed Designs for the Works Specified for First Year of the Contract

The PWD should identify the road sections to be improved in the first year of the Contract and prepare detailed designs of the tasks scheduled for completion in the first year.
The PWD should ensure that the design drawings, schedules and appropriate specifications for the completion of the works are presented in an appropriate manner to be included in the PBC as a separable portion to be paid for in accordance with a schedule of rates. The PWD should also ensure that the results of all pavement testing undertaken to support the proposed designs is incorporated in the contract documents so that the Contractor can either confirm the adequacy of the designs or propose alternatives in his tender submission.

The level of risk transfer to the Contractor shall be determined for these items of work by agreeing with PWD the degree to which the costs are broken down in the schedule of rates.

**13.4.3. Preparation of Engineer’s cost Estimate**

Based on the work completed as stated above the PWD should prepare a confidential Engineer’s cost estimate for each road under the PBC. The purpose of the confidential price estimate is to obtain a benchmark price for each contract against which actual bids can later be compared. Use of the HDM model (or similar) may be made to assure a systematic approach to this step.

The Engineer’s cost estimate is essential for assessment of reasonability of a Contractor’s bid. The cost estimate will be based on a detailed identification of all physical works and other activities (managerial, self-control, etc.), which a Contractor will most likely have to carry out to reach and maintain the defined service level. The cost estimate will be based on prevalent market rates demonstrated through recent or on-going contracts in the State.

This shall include price estimates in separable portions for:

- Initial rehabilitation or improvement works which may be necessary to reach the required service level;
- Maintenance Services,
- Emergency service; and
- Other services and actions, such as the contractor’s self-control system.

Estimation and pricing for emergency works: it is essential to determine and justify as to whether the unit prices for emergency works should be subject to bidding or should rather be fixed in advance, based on existing market rates. If the latter option is elected, identify the prevailing market rates based on recent contracts or those under execution. Further, determine the provisional sum for emergency works for the contracts. Also, identify the work units applicable for emergency works for which unit prices are to be established.

**13.4.4. Preparation of Contract Documentation for Pilot Contracts**

After all the aforesaid tasks have been completed a complete set of contract documents suitable for the UP PWD organization and management should be produced for the pilot contracts. The contract documentation should be generally in line with the Sample Bidding Document published by the World Bank for Performance-based Management and Maintenance of Roads. This document is available on the World Bank’s website under [HTTP://WWW.WORLD BANK.ORG/HTML/OPR/PROCURE/BDOCPAGE.HTML](http://www.worldbank.org/html/opr/procure/bdocpage.html).
The Sample Bidding Document should be modified to incorporate the agreed contract strategy.

In addition to the requirements stated in the World Bank’s sample standard bidding document, the following guidelines should also be followed for preparing the bidding document.

### 13.4.4.1

When Rehabilitation Works and Improvement Works are not specifically required in the bidding documents, it is expected that in order to comply with the contract, the Contractor will most likely have to carry out different types of works, including some small initial rehabilitation and improvements, routine maintenance activities, and periodic maintenance works. The definition of the exact nature of the works, their timing, their costing, and their implementation is left to the judgment of the Contractor.

This means that the Contractor's capacity must be above the usual capacity of a traditional civil works contractor. In fact, an essential attribute is the capacity to manage roads, while the actual physical execution may either be carried out by the Contractor himself, or by different specialized firms participating in a Joint Venture with the main contractor, or under sub-contracts. Joint Ventures may include Engineering firms and medium, small and even micro-enterprises. Consequently, a well-designed pre-qualification process is highly recommended in order to ensure that only qualified bidders participate in the bidding process, even though, the present bidding document can also be used when post-qualification is envisaged. In the design of the pre-qualification requirements the borrower should consider if the experience of specialist sub-contractors (like an engineering consultant) should be allowed to be added to those of the applicants. The activities, which may be delegated by the main Contractor to sub-contractors not participating in the pre-qualification process, should be listed in the Particular Conditions and bidders should be alerted about this point in the Bid Data Sheet.

### 13.4.4.2

Output- and PBC's transfer a significant burden of risk onto the Contractor. It is important that this burden is both equitable and within the capacity of the industry. The contract defines the risk profile carried by the Contractor arising from storm events, legislation changes, changes in traffic volumes, and roadside development.

### 13.4.4.3

Some emergency works should always be foreseen. These are meant to remedy unexpected damage which occurs as a result of extraordinary natural phenomena, and which affect the normal use of the road network, or the safety and security of the users. For emergency works, the contract limits the responsibility of the Contractor, establishing that the Employer will approve execution of services and separate remuneration based on specific amounts proposed by the Contractor for each case, on the basis of volume of works estimated at each time, and on unit prices included in the bid and in the contract.

### 13.4.4.4

The Contractor should be entitled to implement an axle load control system, based on the legislation and in cooperation with local police authorities.

### 13.4.4.5

Bidder’s financial offer will include the following:

- The **Maintenance Services** in the form of the amount of the monthly lump-sum payment demanded by the bidder according to the conditions of contract (this will be a monthly amount applicable throughout the duration of the contract);
• The **Rehabilitation Works** (if so required in the Bid Data Sheet), in the form of a lump-sum amount, while indicating the quantities of measurable outputs to be executed in order that the road achieves the performance standards specified in the bidding documents. Payments will be made in accordance with the progress in the execution of those measured outputs.

• The **Improvement Works** (if so required and for the improvements indicated in the bidding documents) in the form of unit prices for outputs for each type of improvement works; payments for improvements will be made in accordance with quoted unit prices for those outputs; and

• Unit prices for **Emergency Works** in the form of a traditional bill of quantities. Payments will be made for each emergency on a case-by-case basis, in the amount of a lump-sum value estimated by the Contractor and approved by the Employer, on the basis of the estimated quantities and on the quoted unit process.

13.4.4.6 There should also be a price adjustment clause applicable to all prices and activities in order to compensate for increases in cost indices.

13.4.4.7 The agreed monthly payment for maintenance works and services will be made to the Contractor if he has complied, during the month for which the payment is to be made, with the agreed Service Levels on the road network under contract. Together with his monthly invoice, the Contractor will report the result of his own evaluation of compliance with the required Service Levels, based on his own monitoring system, which is mandatory. His statement will then be verified by the Employer or his representative (Supervision Consultant) through inspections. If the Service Levels are not met, payments are reduced, based on a schedule given in the contract. Payments may even be suspended, and the contract cancelled, if the Contractor fails during an extended period to achieve certain minimum thresholds values of Service Levels. The contract describes the formulas used to calculate payment reduction and potential contract suspensions.

13.4.4.8. **CREMA Concept – Bidding**

The content of bidding documents and bid evaluation procedures for a combined paving and maintenance contract depends to a large extent on the degree of freedom left to bidders for offering their own designs and performance specifications for the works based on detailed studies carried out prior to submitting proposals. By and large, two approaches are possible.

**Approach-1:** Under this the prospective bidders are given the responsibility for the detailed design of the project, including the preparation of technical specifications that would ensure compliance with the level of service or performance required under the contract. The bidding document would only need to specify:

• The strip or corridor within which the alignment of the road should lie;

• The class of road with the design speed and related geometrical standards; bridge and other drainage structure type (whether temporary or permanent);

• Pavement standards, including maximum design axle load, life period (equivalent standard axle load repetitions) and level of riding quality (roughness) throughout the contract period;
• Safety and environmental standards; performance specifications similar to the km/month or CREMA for future maintenance; and

• Such other information as the length of the contract period, the schedule for execution of paving, and possibly the maximum budget available for the contract.

However this approach, which surely would stimulate bidders’ creative capacity, entails the risks of:

(i) Having non responsive bids due either to lack of competition resulting from bidders’ reluctance to engage in costly engineering studies or to costs proposals that exceed available budget by a substantial margin; and

(ii) Making bid evaluation a difficult and complex exercise, considering the number and diversity of alternative designs and costs that may be offered.

Approach-2: An alternative, and preferred approach, is for the Employer to remain responsible for the design and engineering and to invite bids for a single and lump sum responsibility contract for the execution of the works as specified, and subsequent maintenance. Under this scenario the bid package would only include the general and particular specifications, drawings, the environmental manual, and a bill of quantities allowing the Contractor to estimate his fixed-price proposal. Furthermore, provision can be made to allow the bidder to offer alternative designs or standards which could later be discussed and eventually agreed upon, as long as the bid offer for the Employer’s specified design corresponded to the lowest evaluated cost.

The CREMA concept may also be applied successfully to include a combined Construction and Maintenance contract (for a new paved road).

Under the CREMA system the Contractor may be provided with a basic design, indicating the minimum standard to apply to the rehabilitation component of the contract. Thereafter the bidder is to inspect the site and, based on his evaluation, can submit a proposal on a lump sum basis for the works. With such type of CREMA system the possibilities of alternative designs or solution could be very few in number, the prediction of pavement performance is feasible while the traffic volume and characteristics could be well defined. Therefore overall resolution of the problem is relatively very easy and the bidder can prepare an offer at reasonable cost, with minor risk in pricing his bid.

In the case of the construction of a new road, the problem is different. There are many more questions to be addressed, more alternative designs are possible, and the quality and responsiveness of bids may vary substantially. Since bidders remain ultimately responsible for any error that they might make in their evaluation, it is desirable to specify a minimum set of requirements regarding alignment, geometrical standards, and pavement design, and drainage structures capacity, in order to ensure a transparent and uniform basis for bidding.

The following requirements and parameters therefore are clearly to be defined in the technical specifications:
For the road: Its origin and end; a preliminary horizontal and vertical alignment; the road class or category in accordance with applicable geometrical standards Codes which specifies, per road class, the design speed and related minimum vertical and horizontal curvatures, maximum gradient, passing and stopping sight distances; and lane and shoulder widths.

For the pavement: A minimum structural design, (i.e. minimum thickness or structural number) the number of equivalent standard axles (ESALs) for design being determined by the bidder (the Contractor could prepare an alternative design on the estimated ESALs to reduce future strengthening and maintenance costs).

For bridges: The minimum span, the final length being selected on the basis of the bidder’s hydrological investigation; the width of deck and sidewalks; the minimum clearance between bridge deck and riverbed; and the seismic coefficient values to be considered for design.

After bids have been opened the offers would be considered responsive and acceptable only if the above requirements are met. Although deficiencies in the items described above are always possible at the preliminary stage of design, such shortcomings could be detected and corrected during the detailed surveys and final engineering studies to be carried out and presented by the Contractor before starting the works.

Regarding the pavement, and consistent with the CREMA contract, special attention should be given to its structural strength in order to ensure that premature failure and subsequent repairs, albeit at the expense of the Contractor, are not likely to occur. Similar criteria are to be used for bridges and drainage structures with deficiencies to be corrected at the Contractor’s expenses. Under such conditions, each bidder understands the necessity to carry out his own design base on a detailed site investigation before tendering, and to incorporate his own experience, including innovative technologies, in order to submit the lowest cost while achieving maximum profit. Also, once the contract is awarded, the Contractor is free to propose, and use, any enhanced technology that enables him to be more cost-effective and to optimize his investment.

General specifications for road works should include all information and conditions that the Contractor is required to meet during the construction and maintenance of the road in order to ensure in a satisfactory manner the operation of minor and major drainage structures, the cleanliness of the roadside, the pavement markings and signs, the guardrails, side slopes, and snow removal.

Except in the event of ‘force majeure’, the contractor remains responsible for the reconstruction or repair of any failure, collapse, or damage occurring on the road.

The requirements of pavement surface condition after construction should be stipulated. These requirements pertain to Roughness, rut depth, cracking, ravelling, potholing and skid resistance.

As under the CREMA system, bids are to be made on a fixed-price basis comprising both the construction and follow-up maintenance. The contract period shall cover the period for both construction and maintenance. An advance payment for site installation may be allowed for, followed by agreed equal lump-sum instalments made at specified interval during the
construction period, with equal monthly payments made thereafter, during the maintenance period.

13.5 PART E - MANAGEMENT OF PROCUREMENT

13.5.1. Pre-qualification of Contractors

If required prepare a Pre-qualification Document, based on the relevant Standard Pre-qualification Document published by the World Bank to which the necessary modifications will be made to render it applicable. The potential bidders will be shortlisted based on this Prequalification document after following the set procedure of pre-qualification process. A prequalification document shall be prepared by the Road agency and would invite the expression of interest from the contractors after wide publicity following all codal provisions. The pre-qualification process should be completely transparent. After the receipt of documents from various potential bidders evaluation of submitted documents shall be done by the competent authority. The potential pre-qualified bidders shall be notified of the outcome. Candidates who are not found fit for pre-qualification should be also informed about the outcome of their submission.

13.5.2. Management of Tender Process and Evaluation of Tenders

Once the pre-qualified Contractors have been identified the bidding process will commence. In case Pre-qualification of bidders is not required, the bidding process may be commenced following post qualification system. Given the complex nature of the work and significant effort required to tender for such work, it is expected that the tender period will be at least two months.

Given the complex nature of the work and significant degree of risk transfer to the Contractor, pre-bid conferencing and tendering workshops may be held with each of the individual tenderers, to ensure that they are fully aware of the nature of the work.

During the tender process, the potential bidders will be provided with such information as necessary for bidding. After the pre-bid conference clarifications on the issues raised by the bidders shall be issued. The employer may issue addenda if any required. After evaluation of bids the bidder will be selected and the contract will be finalized.

13.6 PART F - MANAGE PERFORMANCE: COMPLIANCE MONITORING AND THE MANAGEMENT OF THE CONTRACTS

13.6.1. Contract Supervision

Based on the individual conditions and circumstances of each PBC, the contract to be prepared and suitable supervision arrangements to be evolved. These may be

(i) Through international or local consulting firms,
(ii) Through individual consultants,
(iii) Through Road Agency staff or
(iv) Through other suitable arrangements.
Prepare the ToR's for the various types of supervision arrangements, including estimates of inputs and costs.

Once the Contractor is appointed, the PWD or its appointed Consultant will perform supervision of works and henceforth will be designated as Supervisory Engineer. The scope of services for Supervisory Engineer will be as per the guidelines given hereunder:

13.6.1.1. **Project partnering:** In order to implement the project a cooperative environment is essential for the contract. The Supervisory Engineer and the Contractor will be responsible for ensuring the contract meets its overall goals and addressing issues of concern.

13.6.1.2. **Auditing:** The prime responsibility rests with the Contractor to demonstrate compliance with all aspects of the contract. The Supervision Engineer will conduct random audits of the Contractor’s systems and outputs, and site inspections, which focuses on identifying whether or not the contract is meeting its performance measures. System for monitoring and maintaining asset inventory and condition information will be the responsibility of the Contractor but the Supervision Engineer will make periodic audits to ensure such systems are being kept up to date.

13.6.1.3. **Verifying payment Certificate:** The Supervisory Engineer will verify that the monthly payment certificates are in accordance with the contract.

13.6.1.4. **Variations:** The concept of PBC is that the Contractor completes all work for a fixed lump sum price. Therefore the intention at all times is to ensure the lump sum status is maintained. However, during the contract, it might become apparent that some performance measures are easily being met for less work than originally envisaged, or some standards require adjustments to become more realistic. The Supervisory Engineer regularly reviews such situations and proposes suitable suggestions to the senior officers of the organization to address such circumstances.

13.6.1.5. **Reporting:** The Supervisory Engineer will produce the following reports until completion of the commission:

(a) Monthly briefing to the senior PWD officers
(b) A monthly report with the payment certificate and documenting the results of audit and any potential requirements for alterations to the performance standards.
(c) Ad hoc reports for specific events such as emergencies, which requires immediate specific attention.

13.7 **PART G - FINAL REPORT AND RECOMMENDATIONS**

13.7.1. **Compilation of Lessons Learned**

At the end of the second year of the Pilot Contracts, the PWD shall summarize the achievements and problems encountered during the development and implementation of the projects.
A joint discussion between the Supervisory staff and the Contractors will be carried out to draw up conclusions of the pilot scheme implementation. General issues may include a proper duration of contract, performance specifications, conditions of contract, new technology involved, and partnership enhancement.

Upon compilation of lessons learned, the Supervisory Engineer shall recommend:

(a) Appropriate action plans for future assignments,
(b) Improvement of tender documents, especially the conditions of contracts, and
(c) Performance measures.

The Supervisory Engineer shall also address any other areas where it is felt modifications may be needed and shall give recommendations for the benefit of future implementations.

13.8 CONCLUSIONS

13.8.1 Since PBC is complex nature of work therefore a separate task force should be established in the PWD for establishing a strategy for successful implementation of performance based contracting on the State road network.

13.8.2 As a first step in this direction the PBC should be implemented on pilot projects on two to three sections of the State road network. The term of the pilot contracts should preferably be for a minimum period of three years, with two possible one year extensions based on quality of outcomes achieved by the Contractor. The first year of the contract may include those works which will bring the roads to required level of performance indicators, in addition to routine maintenance. During subsequent years the Contractor shall perform routine, periodic and emergency maintenance works on the road network.

13.8.3 Currently the staff available with PWD are not conversant with PBC. The nature of PBC work is complex, therefore initially the PWD should engage an experienced Consultant to assist them in designing and implementing the pilot contracts. The Consultant should also be responsible for assisting the PWD to establish and implement an appropriate regime for managing the contracts and for identifying future developments based on lessons learnt from the pilot project.

13.8.4 A study cum training tour should be arranged for selected members of the PWD task force to an appropriate country to study the system of PBC's for contracting for road networks. The PBC works will be implemented by Contractors of the State, therefore it is advisable that a limited number of Contractor's representatives should also be invited to participate in the study tour at their own expense. The expenses of study tour of PWD officials shall be borne by the Government.
14. MEETING HELD WITH FOCUS GROUP D

The Focus Group D – Contract, Procurement and Management meeting was held on 27th of July 2007, when this Report was discussed, approved and finalised.

15. PRESENTATION TO PROJECT STEERING COMMITTEE
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<th>PWD Focus Group - D</th>
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**LEA International Ltd. and LEA Associates South Asia Pvt. Ltd.**

| Shri S.K. Pancholy | Contract & Procurement Specialist |
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Objective:
• High Quality,
• Timely completion
• Minimize negative impact to the public – Road safety and traffic delays.

Main Concern
• Reducing the cost of Road maintenance
• Improving road conditions
• Accelerating highway construction
• Minimizing the strain on resources
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Traditional system of awarding contract:

- Contractor responsible for execution of the works
- Client pay on the basis of unit price of different work items
- Contracted to work and act according to client’s specifications,
- Supervisory Engineer is to ensure that work executed meets with the specifications requirements
- Quality of work rests upon Supervisory Engineer
- Contractor’s concern is to complete the project within agreed budget and time.
- Competitive bidding among contractors controls cost
- Lowest bidder is awarded the work
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Limitations of the Traditional Method

- Slow and does not favour life cycle cost approach
- Risk- Contractor not responsible for quality and maintenance as the Employer has prescribed the specifications.
- No input of contractor in design and construction methods
- Employer needs a large number of staff
- Contractor is not required to think about means of minimizing the recurrences of defects.
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Why Develop Innovative Contracting method

- Reduction in Construction time
- Reduction of construction cost
- Application of improved technology and techniques
- Deploying Contractor Innovation
- Reducing Impacts on Public
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Performance based Contracting

- Definition: Structuring the contract around the desired results rather than the method that should be used to accomplish results:

- Meaning structuring all aspects of a project around the purpose of the work to be performed with contract requirements set forth in clear, specific and objective terms with measurable outcome.

- Focuses on key outcomes that the client wishes to achieve.

- Contractor to inspect, plan, design, organize and deliver maintenance services that all assets are fit for purpose and in accordance with specified asset condition standards for a fixed lump sum price.

- Success is defined in terms of outcomes alone, which spark the contractor innovation and improvement in quality.
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Performance based Contracting (contd)

• Establishes long term Public – private partnership between the contractor and the Government

• Focus of contractor is on the integral management of the road assets over a given period.

• Highway Maintenance PBC Contracts- Maintenance of total assets ‘fence to Fence”

• Minimum Performance standards and desired end outcome are specified

• Bonus payments for good or exceptional performance, penalty for poor performance

• Risks transferred to the contractor

• In case Outcomes becomes too complex to specify include some output specified works – Significant Rehabilitation works, Short term contract, pilot contract
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PBC Aims to align the client’s and Road user’s objectives with those of contractor defined by the contract:

- Requiring the contractor to ensure the road network meets the agreed performance criteria
- Contractor to decide the work required to be done
- Long term contract for a fixed lump sum – Provide quality work at optimal cost
- Contractor responsible for all, the client is to oversee the quality of network
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Purpose

• Performance standard is a benchmark against which the success is assessed

• The owner is to focus on the contractor’s efforts on specified customer related needs:
  - Minimal traffic disruption
  - Speed of completion
  - Smoothness level
  - Quiet level of ride
  - Increased level of safety

Thus the Contractor and owner become a team to satisfy the needs of customer
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Specification V/S Performance Standards

- Specification defines or provide a recipe for a specific final product
- Performance standard state what level of performance is expected for the product- How to achieve is contractor’s concern.
- In essence Performance standards represent a step beyond end-result specifications.
- Contractor is allowed to use his expertise and experience to come up with innovative ways of obtaining the desired performance.
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Formulation of Performance Standards

Performance standards addresses smoothness, safety, congestion, and other aspects of quality.

Criteria to be considered for formulation of performance standards

- Availability of Standard Test procedures
- Feasibility of applying the performance standards within the context of Highway construction projects
- Clarity of the standards to the desired outcome – improved safety, reduced construction – related congestion or improved quality

Standards should be set at a level of performance well above average but within bound of what has been achieved with current best practices and technologies.
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Performance Standards and Response Time

Typical performance standards

Affects VOC- IRI- to measure roughness

Affects Safety and pavement performance:- Potholes, cracking, rutting

Affects Safety: Skid Resistance of road surface

Deterioration: Destruction of Road structures

Affect safety- Road signs and pavement marking
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Performance monitoring and Payment procedures

Aim: Contractor to manage the Contract and Employer to monitor

Contract document to have provision for

- Appropriate Control Procedures- Inspection by the contractor and Employer
- Penalties for Non-compliance
- Well documented inventory of the road and daily records of activities undertaken by the contractor.
- Maintenance of compliant /suggestion book
- Payments to contractor based on results of monthly inspections
- Full payment when 100% compliance
- Penalties if contractor does not rectify established deficiencies within certain time limit.
- Contractor to have in place- Proper management and quality control system
- Maintain Records of: Inspection, Quality control procedures and works undertaken
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**Beneficiaries**

- Road users – Know the service level that they can expect in return for the payments they make for the use of road
- PWD - Better overall road conditions for the same levels of expenditure
- Contractor: Open new business opportunities, longer contract periods
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Performance Based Management and Maintenance of Road (PMMR)

- PMMR increases the efficiency and effectiveness of road maintenance operations
- Physical condition of the road under contract are in good or in fair condition and remain substantially in that condition for the entire period of contract by application of – Routine maintenance

Combined Rehabilitation and Maintenance Contract (Hybrid):

- A combined Rehabilitation and Maintenance Contract
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Specifications:

1. Performance Related Specifications:
   • Levels of key materials,
   • Construction quality characteristics

2. Performance Outcome based Specifications
   • Describe how a finished product should behave over-time.
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Development of Performance based Specifications;

Steps

• Defining Functional requirements
• Determining performance acceptability and Compliance
• Outlining Incentive, remedies and penalties
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Procurement of works and services

Structure of biding Document;

- Bidding requirements
- Work requirements
- Conditions of contract and contract form
Conclusion and Recommendations

• Securing finance on a long term basis is critical to success
• Each performance contract is to be tailored to each specific situation
• Plan and implement the pilot scheme carefully
• Well qualified Contractors and inspectors
• Proper performance monitoring and strict application of non-compliance
• Contract should be comprehensive to cover the different assets
• Positive approach to cooperation and partnership between the client and contractor is required
• Ensure that the performance standards are achievable and the client’s objectives,
• Inventory of all assets
• Procurement process to be transparent
• Risks must be clearly defined
• Client must have capacity to manage
• Contractors to able to establish clear system for compliance monitoring
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Design and management of Performance Based Contracts
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Strategy:
1. Determination of Road agency’s needs
2. Preparatory Engineering works
3. Rehabilitation works
4. Emergency works
5. Performance standards
6. Preliminary cost estimates
7. Prequalification of contractors.
8. Contract price
9. Incentive and penalties
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Activities:
1. Establish integrated solution teams
2. Selection of Road sections to be included
3. Define service level
4. Evaluation of Contractor’s capacity to undertake and manage the works
5. Grouping and packaging
6. Developing Contract format
7. Proposed Performance Criteria
8. Long term asset performance measures
9. Operational performance measures
10. Management performance measures
11. Minimum Engineering standards
12. Quality framework
13. Bid Evaluation procedures
14. Industry consultation workshop
15. Contract Strategy report
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Review of the adequacy of current information and collection of any data

• Review of the adequacy of current information
• Collection of roughness, rutting and texture data
• Collection of additional data
• Video Recording
• Data Report
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Development of Contract Documentation
Development of Long-term programme of work
Detailed designs for the works specified for first year
Preparation of Engineer’s cost estimates
Preparation of Contract Documentation
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Management of Procurement

Prequalification of Contractors

Management of tender process and evaluation of tenders
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Manage Performance compliance monitoring & the Management of the Contract:

- Project partnering
- Auditing
- Verifying payment certificate
- Variations
- Reporting
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Final report and recommendations
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Conclusion

• Pilot project on two to three sections - 3 years terms with extension by one year
• Engage experienced Consultant
• Training of staff and contractor
1. INTRODUCTION

Maintaining a road network includes both routine and periodic tasks. Routine maintenance consists of many different tasks frequently necessary to maintain the function of the road (such as pothole repairs, cleaning of drainage, sealing of cracks, cutting of vegetation, etc.). Periodic maintenance consists of predictable and more costly measures of a less frequent nature designed to avoid road degradation (such as grading, drainage work, resurfacing, bituminous concrete overlays, etc.). Intelligent management, the timeliness of interventions, and the adequacy of technical solutions are critical. It is expected that the use of private specialised firms under output and performance-based contracts will unleash significant efficiency gains, and stimulate innovation in comparison with traditional road administration practices.

2. COMPONENTS OF PMMR CONTRACTS

Normally performance-based contracting for maintenance is based on Kilometer / month unit, where the Contractor is paid on a monthly basis for specified services provided either to the road users or to the PWD, and only when the quality outputs comply with the technical specifications included in the contract. If the quality outputs, for any specific activity, are not in compliance with the prescribed requirements, penalties are applied on a daily basis and subtracted from the forthcoming payments, until the necessary repairs are carried out.

The PMMR contract comprises of three main items or components namely:

(i) Maintenance Works: Maintenance works are paid on a lump sum basis as a fixed amount per month per km of road maintained

(ii) Site Installation: Site installation is also paid on a fixed-price basis, at a specified rate (say one-third) at the completion of site camp installation and at a pre-specified rate (say two-thirds) when all the equipment and personnel necessary for the works are mobilized onsite. And

(iii) Emergency Works: Emergency works, i.e., items or services not included in the maintenance work component, are paid on the basis of unit prices and quantities related to any additional transport, equipment, or tons of asphalt concrete which may need to be supplied and placed for unexpected extensive repair.

2.1 Maintenance Works

The consideration towards Maintenance Services is payable in the form of a fixed amount of the monthly lump-sum payments as mutually agreed and stated in the conditions of contract (this will be a monthly amount applicable throughout the duration of the contract).

There may also be a price adjustment clause applicable to all prices and activities in order to compensate for increases in cost indices.
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Such contracts are for a specified duration and are renewable. They comprise essentially a specific road section or a sub-network, which is free from deep rutting and longitudinal or alligator cracking. Such roads may have been recently resurfaced, rehabilitated, or paved under a separate rehabilitation project. These maintenance contracts do not normally include any substantial investments for strengthening, widening, or upgrading the infrastructure concerned, for which a residual life of at least five years is expected.

Penalties, as indicated in the contract are applied in accordance with the deficiencies noted during inspections carried out at a specified monthly frequency. A period as specified following the award of the contract is waived, during which penalties are not applied in order to enable the contractor to repair and fix any deficiency existing at the time of contracting. Each inspection tour is followed by a written "statement of deficiencies" (eventually photo-documented), agreed and signed by the Engineer and the Contractor's representative on site. Inspections are normally carried out on a sample basis, the minimum length to be inspected weekly representing a fixed percentage of the total length of the contracted network (or a specified percentage if the inspection is for the purpose of establishing payments certificate).

In addition to the mandatory inspection tours, the Contractor is required to make his own inspection on a daily basis, and to report to the Engineer any abnormality observed (such as traffic overloading) that may have an impact on the contract or on the processes by which the maintenance works are carried out. Likewise, accidents attributable to users are to be reported, especially when they involve damages to the infrastructure itself.

The Contractor must also comply with national environmental standards, and apply all mitigating measures related to borrow-pits and to the disposal of all unsuitable materials removed from the pavement or its surroundings.

The contract documents include:

i. The Contract itself;
ii. Particular Technical Specifications (Performance Standards)
iii. General Specifications for Road works in use in the state;
iv. A detailed report on the actual condition of the road or network to be maintained, including a set of relevant maps and drawings;
v. Environmental Manual as applicable; and
vi. Standard Unit Costs applicable to emergency works such as transport of materials, hours of rent for equipment and specific maintenance crews, and ton or cubic meter of asphalt concrete patching.
vii. Monetary penalties applicable for non-compliance with the particular Technical Specifications

The contract provides for the PWD, on an exceptional basis, to carry out by force-account or through a third party, any works or activities of an extraordinary nature, but limited to at most a specified percentage of the total length or duration of the contract. The contractor, duly advised in advance, may only object to such an intervention by the PWD (including canceling the contract) if the specified limit is exceeded. Likewise, the implementing agency may terminate the contract if the Contractor does not perform in accordance with the General or Particular Technical Specifications.
2.2 Site Installation

Site installation comprises the supply of all offices, equipment, materials, and personnel necessary to carry out the maintenance works, including the facilities to be provided for the supervision team. It is paid on a lump sum basis (a fixed percentage of the total contract amount). The amount due may be paid in two installments: the first installment representing one-third of the total to be paid at the completion of the site camp installation and after due justification is given of the right size and expertise of the personnel to be employed for the works. The payment of the remaining two-thirds occurs after the arrival on site of equipment and personnel.

2.3 Emergency Works

Some emergency works should always be foreseen. These are meant to remedy unexpected damage which occurs as a result of extraordinary natural phenomena, and which affect the normal use of the road network, or the safety and security of the users. For emergency works, the contract limits the responsibility of the Contractor, establishing that the Employer will approve execution of services and separate remuneration based on specific amounts proposed by the Contractor for each case, on the basis of volume of works estimated at each time and on unit prices included in the bid and in the contract. A provisional sum is normally set aside for emergency works.

Payments will be made in accordance with the progress in the execution of those measured outputs at Unit prices for Emergency Works in the form of a traditional bill of quantities. Payments will be made for each emergency on a case-by-case basis, in the amount of a lump-sum value estimated by the Contractor and approved by the Employer, on the basis of the estimated quantities and on the quoted unit process.

2.4 Payments

The agreed monthly payment for maintenance works and services will be made to the Contractor if he has complied, during the month for which the payment is to be made, with the agreed Service Levels on the road network under contract. Together with his monthly invoice, the Contractor will report the result of his own evaluation of compliance with the required Service Levels, based on his own monitoring system, which is mandatory. The Employer, or his representative, or consultant appointed by him, will verify through inspections the statement submitted by the Contractor.

If the Service Levels are not met, payments are reduced, based on a schedule given in the contract. Payments may even be suspended, and the contract cancelled, if the contractor fails during an extended period to achieve certain minimum thresholds values of Service Levels. The contract describes the formulas used to calculate payment reduction and potential contract suspensions.

3. CONTRACTOR’S OBLIGATIONS

During the bidding process, Contractors compete among each other by proposing a fixed monthly lump-sum fee per km of road to be paid to them. It is important to understand that Contractors are not paid directly for “inputs” or physical works (which they will undoubtedly have to carry out), but for “outputs,” i.e., the initial rehabilitation of the road to pre-defined standards (if
so required by the bidding documents), the maintenance service of ensuring certain quality levels on the roads under contract and specific improvements (if so required by the bidding documents).

The monthly lump-sum remuneration paid to the Contractor will cover all physical and non-physical maintenance services provided by the Contractor, except for unforeseen emergency works, which would be remunerated separately. The initial rehabilitation works, which have been explicitly specified by the Employer in the contract, would be quoted on the basis of measurable output quantities and paid as performed.

In order to be entitled to the monthly payment for maintenance services, the Contractor is to ensure that the roads under contract comply with the service quality levels, which have been specified in the bidding document. It is possible that during some months he will have to carry out a rather large amount of physical works in order to comply with the required service levels and very little work during other months. Yet his monthly payment remains the same as long as the required service levels are complied with.

One fundamental feature of the performance-based contract is that the Contractor is responsible for designing, scheduling, and carrying out the actions he believes are necessary in order to comply with the service quality levels stated in the contract. The service quality levels are defined from a road user’s perspective and may include factors such as average travel speeds, riding comfort, safety features, etc. If the service quality is not achieved in any given month, the payment for that month may be reduced or even suspended. Under the performance-based contract, the Contractor has a strong financial incentive to be efficient. In order to maximize profits, he must reduce his activities to the smallest possible volume of intelligently designed interventions, which nevertheless ensure that pre-defined outputs (measured indicators of service level) are achieved and maintained over time.

It is essential for a PMMR contractor to have a good management capacity. Here, “management” means the capability to define, optimize and carry out in a timely basis the physical interventions which are needed in the short, medium, and long term in order to guarantee that the roads remain above the agreed service quality levels.

In other words, within the contract limitations and those required to comply with local legislation, technical and performance specifications and environmental and social regulations, the Contractor is entitled to independently define:

(i) what to do,
(ii) where to do it,
(iii) how to do it, and
(iv) when to do it.

The role of the PWD is to enforce the contract by verifying if the agreed service levels have been complied with, as well as all other legislation and regulations the Contractor must comply with.

The Contractor should be able to implement an axle load control system, based on the legislation and in cooperation with local police authorities.
ANNEXURE-2: SALIENT FEATURES of CREMA CONTRACTS

1. INTRODUCTION

Besides Routine and periodic maintenance on the entire length of road network the Contractor is required to perform rehabilitation and/or improvement works of a sub-section of road network in part lengths.

The Rehabilitation Works (if so required in the Bid Data Sheet), in the form of a lump-sum amount, while indicating the quantities of measurable outputs to be executed in order that the road achieves the performance standards specified in the bidding documents. Payments will be made in accordance with the progress in the execution of those measured outputs.

The Improvement Works (if so required and for the improvements indicated in the bidding documents) in the form of unit prices for outputs of each type of improvement works payments for improvements will be made in accordance with quoted unit prices for those outputs.

2. FEATURES of CREMA CONCEPT

The CREMA system has the following specific features:

- Focus is on road users’ satisfaction and on Contractor’s performance to achieve a minimum level of service, rather than on inputs, i.e., quantity activity and unit rates compliance.

- The system, which prescribes that the Contractor sets up his own quality control system, reduces the need for time and staff consuming (thus costly) supervision, by eliminating redundant quantities and quality-testing of activities performed. Inspection team size and tasks are reduced to the bare minimum.

- The risk of cost overruns is considerably reduced since contracts are fixed-price.

- Delays in project implementation, which in traditional programs are due to lack of stock of prepared sub-projects, are minimized since the Contractor is required to carry out a detailed engineering design before initiating the works.

- The use of CREMA contracts deters the Government from failing to provide stable funding for road maintenance sector as the long-term payment obligations under these contracts become legally binding on the Government.

- The risk of unsatisfactory quality in the capital (rehabilitation) works is greatly reduced by the obligation of the Contractor to maintain the roads over a five-year period.
• The system fosters innovation on part of the Contractors in the programming and execution of works since acceptance and payments are not tied to rigid specifications related to workmanship but rather to end results and level of service.

• The design of the program requires the PWD to provide reliable network conditions and traffic surveys.

3. PAYMENTS

The payment schedule is designed to ensure that the Contractor maintains the network for the full length of the contract after a specific rehabilitation and/or improvement period.

During the rehabilitation period the Contractor receives advance payments at the agreed rate and interval stated in the contract. On completion of the rehabilitation period the Contractor is paid the balance amount in equal monthly amounts spread over the remaining contract period. A performance guarantee is required under the Contract.

Payments are made when a specified level of service is achieved and not on the basis of pre-determined bill of quantities and unit rates as in admeasurements-type of contracts. Performance is assessed during periodic inspections jointly carried out by the Engineer and the Contractor. The rehabilitation works must comply throughout the contract period (and in particular with the specified minimum thickness of overlay), to a maximum roughness level (as specified), and maximum values of rut depth, cracking or ravelling. Maintenance activities are broken down into a few essential items that are regularly inspected to ensure compliance with the specifications, such as: potholes, cracking, rutting on the pavement, and condition of shoulders, culverts and drains, roadside, environment, vertical and horizontal signs, lane marking, and guardrails.

For each item, penalties for non-compliance are set and applied in such a manner as to deter the Contractor from failing to comply. For example, a pothole left un-repaired beyond the authorized time limit will cost the Contractor a heavy amount per day until it is patched. The total amounts of penalties are deducted from the monthly payments.

4. THE CREMA CONCEPT TO LOW-VOLUME ROADS

Engineering-economic Characteristics of Low-volume Roads

An overriding consideration in designing a paving program for low-volume roads, under budget constraint, is to ensure that the investment will yield an acceptable internal economic rate of return, generally more than 12%.

Strengthening and renewal of bituminous roads carrying between 50 and 200 vehicles a day may be economically justified – considering vehicle operating cost savings alone – provided the initial investment is substantially low. In order to keep project cost low, it is necessary not only to reduce the amount of earthworks and the drainage system to minimum standards, but also to design the pavement structure (which may represent more than 50% of the total cost), to provide good riding quality at the lowest possible cost. Thus, the design of low-cost pavements invariably
implies the use of local and possibly sub-standard materials for the base-course and surface dressing for the wearing course.

Further an efficient and good quality control during works execution is of paramount importance, as well as the implementation of a timely and effective maintenance program, once the road is open to traffic.

Another specific design feature related to paving low-volume roads is the generally recommended practice of stage-construction: the uncertainties associated with traffic projections and the long-term performance of non-traditional materials, militate in favor of a stage-construction approach which calls for the postponement in the execution of an asphalt concrete wearing course (or the construction of more permanent bridges) until such time as pavement condition or traffic characteristics so warrant. Unless the necessary financial resources have been secured and released on time by the Treasury, the stage construction approach runs a substantial risk of failure.

The above provide a strong analytical rationale to justify the extension of the CREMA concept to low volume roads. By contracting on a lump sum basis to the private sector a long-term combined paving and maintenance program, while monitoring performance rather than inputs or activities, a number of the above-mentioned issues can be resolved. Contractors are likely to be more alert to quality and reliability considerations during works execution if they are held accountable in the future for the quality of service offered by the road. The permanent presence of the Contractor’s maintenance crews on site guarantees an efficient monitoring of pavement and traffic conditions, enabling corrective actions to be implemented without delay. The recurrent problem of scant and unreliable budgets for road maintenance are avoided, while the need for stage-construction, i.e., to strengthen the pavement structure in phases is automatically fulfilled, as an integral part of the combined paving and maintenance contract.