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Performance Based Contracts in the Road Sector: Towards Improved Efficiency in the Management of Maintenance and Rehabilitation

Brazil's Experience

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PERFORMANCE BASED CONTRACTS IN THE ROAD SECTOR:

TOWARDS IMPROVED EFFICIENCY IN THE MANAGEMENT OF MAINTENANCE AND REHABILITATION

BRAZIL'S EXPERIENCE

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FOREWORD

With globalization and the constant reorganization of production and distribution chains, logistics have become a key determinant of inter-regional trade and international competitiveness. While the Brazilian overall economy has shown impressive improvement over the past decade, the country's economic growth remains hampered by high logistics costs, which still represent about 15 to 18 percent of GDP. This is well above those of China and India and nearly twice the 9 percent average cost in OECD countries.

High logistics costs stem in part from the way the transport sector is organized, a situation largely inherited from the past marked by years of low investment in transport infrastructure and a focus on the roads subsector. As a result, logistics nowadays heavily rely on the costly road transport mode, which carries some 60 percent of goods and 95 percent of passengers. Ironically, given the scarce resources allocated to the sector, the road infrastructure itself has remained in an overall poor condition until very recently, further contributing to the high cost of transport. Various initiatives have been undertaken since 2000 to improve the management of the sector, including institutional and policy reforms; a renewed long-term transport planning exercise; increased participation of the private sector through concessions and performance-based contracts; release of budget constraints notably since 2005; and the implementation of large multi-year investment programs.

Despite these efforts, further improvements in the management of the transport sector remain essential to contribute to reduce logistics costs in Brazil and foster increased economic growth. In 2007-2008, the World Bank initiated an Analytical Advisory Activity (AAA) which takes stock of the progress to-date in the management of the sector and focus on investigating ways to further improve the efficiency of public expenditures in the sector. A number of activities have been undertaken under this AAA, including technical assistance and original research into the functioning of the transport sector, resulting in the following studies: *Brazil's Experience with Performance-based Contracts in Road Rehabilitation and Maintenance; Private Participation in the Road Sector in Brazil;* and *An Appraisal Framework for Transport Investments.*

The present paper, *Brazil's Experience with Performance-based Contracts in Road Rehabilitation and Maintenance*, investigates and details Brazil's successful experience with performance based contracts for the management of the road infrastructure and explores approaches for future improvements in Brazil's performance based program. It is our hope that this paper will contribute to the vibrant discussion among Brazil's policymakers, advisors, financiers and private sector partners on how best to reduce the cost of logistics, increase trade and bolster economic opportunity for all Brazilians.

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ABSTRACT

This note aims at providing feedback on Brazil's successful experience in using performance based contracts in the rehabilitation and maintenance of the road networks. Since its introduction in the early 2000's, the use of this contract management model has progressively spread to reach, as of today, 1/3 of the federal network and more than 10 percent of the states' networks, and expectations are for higher figures in the short run.

The note highlights the context which led to the introduction of these contracts in the road sector and the strategic orientations adopted in their structuring. The model was notably expected to bring rationalization, accountability and credibility to the sector at a moment when road maintenance, though a crucial issue when considering the networks' characteristics and conditions, was not given sufficient consideration by the road administrations.

The note then provides an evaluation of the positive achievements resulting from these contracts. The evaluation, comparing objectively performance based contracts to the traditional input-admeasurements approach, shows that these contracts brought an overall improved efficiency to the sector which translated to better road conditions at lower costs for the governments and reduced management burdens on the administrations.

Finally, the note provides insights, gained from ten years of continuous learning, on the main lessons learnt, and perspectives on desirable evolutions in the future: while a balanced share of responsibilities and initiatives between the public and the private sectors is essential, strengthened administrations, fully accountable for preserving public interests, remain key to success; better articulating contract duration and rehabilitation works service life, which would lead to extended contract duration, is also one of the possible orientations for future performance-based contracts in Brazil.

INTRODUCTION

1. Performance based concept in the management of road maintenance and rehabilitation has been introduced in Brazil ten years ago, through the execution of the CREMA (*contratos de reabilitacao e manutencao – Rehabilitation and Maintenance Contracts)*, under two World Bank-supported projects.[1] The concept proved attractive and, as a result, spread progressively in the country, often with Bank support: by late 2008, more than 150 performance based contracts had been executed and close to 30,000 km, or 16 percent of the Federal and State cumulated paved networks, were managed under performance based contracts (Table 1).

Table 1. – Performance based contracts in Brazil

	Federal		States*		Total	
	Contracts	**Network**	**Contracts**	**Network**	**Contracts**	**Network**
Completed	119	18,688	33	12,000	**152**	**30,688**
In execution	95	15,178	31	14,600	**126**	**29,778**
Total	**214**	**33,866**	**64**	**26,600**		

** including maintenance only and maintenance and rehabilitation performance based contracts*
Source DNIT, DERs, the World Bank,

2. In fact, as of today, several Brazilian road agencies resort to performance based contracts in the management of part or all of their road networks, as is the case at the Federal level and in the state of Minas Gerais, where both rehabilitation and maintenance are primarily executed through these contracts, or in Goias, where maintenance of the full road network is executed under performance based contracts. Other states, such as Bahia, recently launched new phases of their road rehabilitation and maintenance programs following the performance based concept or are structuring pilots (as in the State of Tocantins). Finally, several performance based management principles have gradually been introduced in brown-field road concessions since 2007.

3. Looking ahead, performance based contracts use in Brazil is expected to grow at an accelerated path. Indeed, Brazil's Ministry of Transport formally launched a program (PRO-CREMA) aiming at contracting 7,000 km of new CREMA type contracts per year[2] with the objective to eventually manage 75 percent (or 32,000 km) of the federal main paved road network with CREMA; and an increasing number of States are contemplating performance based contracts to manage their own road networks.

4. Maintenance based on performance has spread worldwide for the past 15 years a fact well documented in the literature[3] and this note intends to evaluate the use of this contract in the specific case of Brazil that displays a quite unique experience. It also outlines achievements, identifies issues, presents lessons learnt and proposes possible orientations for the future.

[1] The Federal Highway Decentralization project (1997) and the Rio Grande do Sul State Highway Management project (1997).
[2] Decree #7 (2008) http://antigo.sicepot-mg.com.br/PortariaN7MinisterioDosTransportesJan2008.html
[3] For example, World Bank resource guide: http://www.worldbank.org/transport/roads/resource-guide/index.html

I. ROAD MANAGEMENT IN BRAZIL

A. Sector Background

5. ***Brazil road system*** covers about 1.6 million km, of which approximately 13 percent is paved[4] (close to 211,000 km). It is managed under three levels of jurisdictions, depending on the relative importance of the network considered: the federal, the states and the municipal levels. Overall characteristics are provided in Table 2.

Table 2. – Brazil road networks' characteristics

	Paved	Unpaved
Federal	48,901	10,555
Transferred*	11,450	3,050
State	123,610	119,655
Municipal	26,770	1,288,941
	210,731	1,422,201

* network transferred from the federation to the states

Sources DNIT, DERs, the World Bank

6. ***Large parts of the federal and state road networks***, with pavements that are 20 to 40 years old and have years of backlog maintenance, reached the end of their life cycle expectancy[5] by the end of the 1990's to early 2000's. As a result, many of these roads, supporting ever denser and heavier traffic, began a phase of accelerated deterioration, requiring road policies to rapidly substitute priorities from construction to strengthened maintenance and rehabilitation as necessary. The cultural change required for the substitution to materialize did not occur with the speed and force ideally needed.

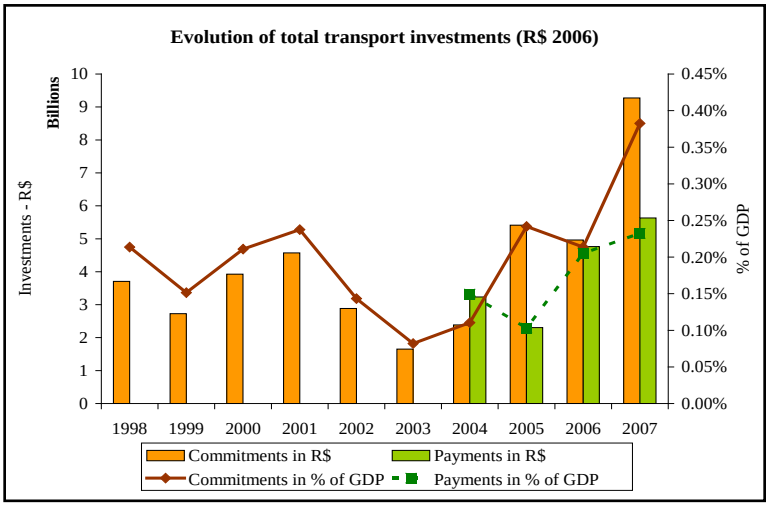
7. ***Brazil has dealt with serious economic and financial difficulties until 2003-2004***, including hyperinflation until 1994, an economic crisis following the Asian crisis (starting in 1998-1999), and severe financial and fiscal difficulties in the first half of the decade. During this period, characterized by scarcity of public investments and high to extremely high interest rates, many investments needed in the road sector were postponed, particularly in rehabilitation and maintenance. In recent years though, the situation improved, with large increases in both public and private sectors investments and partial earmarking of financial resources for investments in the transport sector[6] which translated into improved road network conditions (Graph 1: Transport investment evolution in Brazil and Graph 2: Federal road network conditions).

[4] Sources Ministry of Transport/DNIT, 2007 data. Detailed conditions available on http://www1.dnit.gov.br/rodovias/condicoes/index.htm

[5] More than 2/3 of the actual federal paved network has been paved between 1965 and 1985 (Annex 3).

[6] Part of the CIDE tax (*Contribucao para Intevencoes no Domanio Economico – Contribution to Interventions in Economic field*)

Graph 1. – Investments in transport in Brazil[7]



8. ***Historically, Brazil's road construction industry*** has focused on large infrastructure works (roads construction) rather than on dispersed and low-return activities like road maintenance and rehabilitation, and did not seem very interested in undertaking such activities. In addition, after more than a decade of severe under-funding in the sector (over the 1990s and beginning of the 2000s), the road construction industry had reduced investments in their equipment renewal and consulting firms had started to diversify their activities away from the sector. The industry recovered part of its capacity in recent years, but capacity bottlenecks have started to emerge since late 2007 given a three-fold increase in demand for road works.

9. ***Many road administrations have been slow at adapting their structure and organization to more modern management methods,*** hindered by strong financial constraints and burdensome bureaucracy, as well as a low focus on improving efficiency of such administrations. While most road agencies have improved their contract management capacity over the last 10 years or so, the speed and extent of such progress has generally been hampered by a lack of progress on some fundamental issues, some of which lay beyond the road sector. Despite some institutional improvements, administrations' cultures are notably still oriented towards compliance rather than performance.[8]

10. Human resources have been part of the problem: as in the rest of the public sector in Brazil, no significant hiring has been allowed in road administrations during the 1990's and the early 2000's, and selection of managers has not always been primarily based on technical criteria. In addition, the profile of civil servants is not necessarily adapted to management (vs. undertaking) of public investment programs, and the lack of significant public resources for investments in the sector during this period has resulted in low staff motivation.

11. The low efficiency of planning activities, monitoring systems, administrative and operational burdensome procedures in preparing and executing public investment programs are also part of the problem. In road agencies, more than too often: planning of road investments based on economic and technical criteria remains indicative; the quality of engineering designs remains unsatisfactory; the procurement and management of contracts

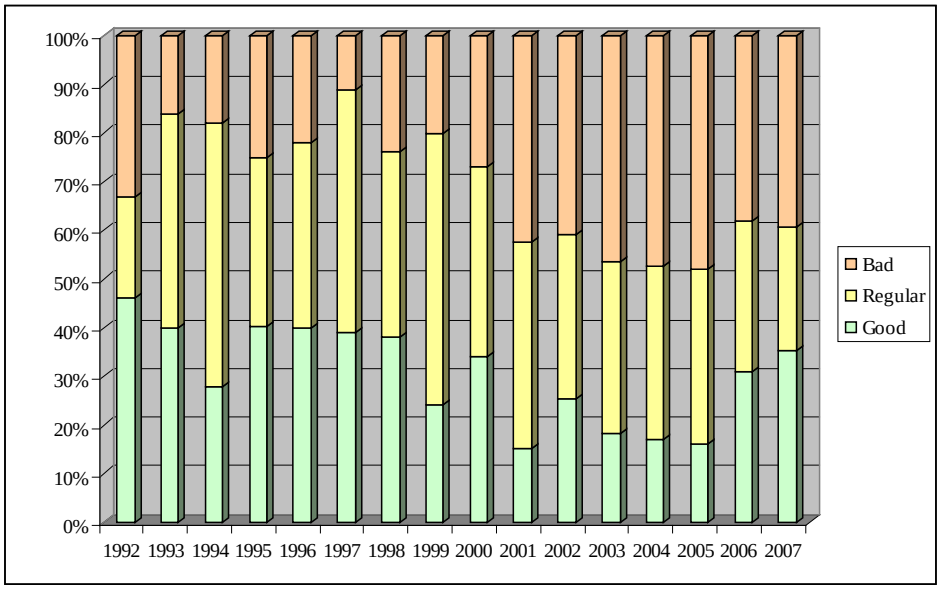
[7] Differences observed in the graph between commitments and payments result from a mix of reasons among which: (i) the natural inertia of road works programs, which usually require long preparatory activities and (ii) the difficulty of administrations in adapting program management to rapidly evolving circumstances.

[8] By contrast, result-based management principles have been gradually introduced in public sector administrations in various OECD countries over the past 20 years. See possible perspective in paragraph 73.

remain inefficient; works supervision remains ineffective; and information management systems remain scattered, isolated and of restricted scope.

12. The conjunction of those factors led to rampant deterioration of the networks' conditions from the 1990's to the mid-2000, hardly stabilized since budgets constraints were removed starting in 2005, as illustrated in the case of the federal network in Graph 2.

Graph 2. – Federal paved network condition evolution



Source: DNIT 2008 (http://www.dnit.gov.br/)

B. Road Maintenance – from force account to performance based contracts

13. Much of the paving at the federal and state levels has been executed in the 1960's and 1970's (Annex 3). With road infrastructure growing older, maintenance (and rehabilitation) has progressively emerged as the crucial issue in the management of the road networks. Such maintenance, initially executed by force account, has been gradually transferred to the private sector starting in the mid-seventies through traditional unit-price (admeasurements) contracts.

14. ***The force account maintenance model was progressively abandoned*** as it was raising several performance issues, among others: a lack of flexibility in the administration to appropriately adapt and manage their means and services to the growing need in maintenance services and works; the chronic unavailability of equipment, which was often inadequately maintained; the diversion of available equipment for purposes other than road maintenance such as politically rewarding paving works; heavy bureaucratic processes (for example, in the use of consumables). The impact of these issues was further compounded by low levels of motivation among administrations' staff.

15. However, the new paradigm which aimed at transferring to the private sector the maintenance of the road networks paid on the basis of service and material inputs, did not fully match the expectations to address the unfavorable context described in paragraphs 4 to 10 above. Consequently, many road administrations saw their outputs drop significantly by the end of the 1990s, both in terms of road maintenance services as well as rehabilitation and construction works, at the worst moment for the road networks. In a number of states, road rehabilitation programs were limited to externally-financed road rehabilitation works, a scale clearly insufficient to meet the needs for road rehabilitation (Box 1).

Box 1. – The road sector in the State of Rio Grande do Sul in the early 2000's[9]

By the end of the nineties, most states in Brazil were in a very difficult fiscal situation, with a number of them on the verge of bankruptcy. The threat to the national economy was real, and in 1998, the federal government engaged in a process of debt restructuring with 25 out of the 27 states. The Fiscal Responsibility Law was then approved in 2000, which consolidated Brazil's fiscal policy.

The Rio Grande do Sul fiscal situation was particularly delicate, and it took until 2003 to see the initial results of the implementation of its fiscal adjustment policy. The government had received a loan from the Bank to support the road network rehabilitation program in 1997, but rapidly, the state rehabilitation and maintenance program was restricted to the Bank funded Project.

Especially over the period 2000-2003, the state had to drastically cut on expenditures to ensure it could meet its monthly payment obligations, and it found itself in a situation where less than 2 percent of the state's revenues were available for discretionary expenditures, including investments, notably in the road sector. Additionally, the state road agency's efficiency in managing the state network was affected by its outdated central information system, an insufficient number of highly trained technical staff (partly as the result of hiring restrictions imposed by the State as part of its fiscal adjustment effort) and state-wide lengthy and complex administration processes. Over the 1997-2000 period, 400 km of the paved network was rehabilitated compared to an initial Bank funded Project target of 1,900 km.

16. Given the above described context, the federal government and the government of the state of Rio Grande do Sul approached the Bank, at the end of the 1990s, looking for more efficient alternative strategies and instruments to manage road maintenance services and rehabilitation works. The basic objectives of such strategies and instruments were to:

(i) contribute to improving, within the limitations posed by the prevailing environment, the ***efficiency of the sector*** at all steps of the project cycle, including works and services planning, procurement processes, engineering design preparation and review and contract management and supervision;

(ii) contribute to ***minimize the effects of budgetary freezes*** (the so-called *contingenciamento*), avoiding stop-and-go's in contract execution, and the resulting lower quality of works and large cost increases to the public sector; and

(iii) ***increasing government commitment*** to allocate acceptable budgets for road investments in maintenance and rehabilitation determined in accordance with technical and economic criteria.

17. Increasing the private sector commitment (and accountability) towards quality in works and services by transferring to them as much responsibility as possible (in line with the principles of the road concessions program launched in Brazil in 1995-1998), was seen as one of the most promising leads to meet these objectives. This transfer was also expected to reduce management burden on a weak public sector.

18. As a result of the discussions held between the respective governments and the Bank, a model of performance based contracts for road maintenance and rehabilitation was structured through the CREMA type contracts (*Contrato de Reabilitacao e Manutenacao* – Rehabilitation and Maintenance Contracts*)*, on around 5,160 km (close to 10 percent) of the federal paved road network and around 2,550 km (or 50 percent) of the state paved road network in the State of Rio Grande do Sul in early 2000. It was complemented in 2001 by lighter forms of CREMA contracts (called *Creminha*, later *PIR IV* and now *CREMA 1a Etapa*) progressively extended to about 9,750 km of the federal paved road network (see more details on this form of CREMA in section II.C.).

C. Basic principles of the performance based model in Brazil

19. Three basic principles were followed in structuring the model for performance based contracts, taking into account recent international experience, Brazil's particular context and the situation in the sector.

[9] Brazil Rio Grande do Sul Highway Management project's ICR http://go.worldbank.org/F5LFYP2G70

Bringing rationalization and generating economies of scale

(i) the preparation of engineering designs was standardized with technical solutions for pavement rehabilitation derived from a specifically adopted norm (a catalogue defining the standard solution for each road situation) and simplified engineering design reports. This forced homogenization and simplification of projects were designed to contribute to (a) reduce design costs, (b) limit time needed for design preparation, and (c) containing the risk of heavier and costlier technical solutions often unjustified in the cases of rehabilitation and maintenance, where required solutions are generally well known and simple;

(ii) maintenance services and rehabilitation works were to be bid together under contracts covering larger extensions: instead of a typical 80 km length (for rehabilitation) to 130 km (for maintenance) in the traditional input based contracts approach, the new contracts would cover longer road sections from 450 to 600 km per contract. Larger contracts would further contribute to (a) increase construction industry interest in road maintenance and rehabilitation with potential economies of scales, and (b) provide more homogeneous maintenance conditions on road itineraries;

(iii) contract duration was increased up to the maximum 5 years authorized under the Brazilian public procurement law from an average of 1.5 years under traditional rehabilitation contracts and 1 to 2 years in maintenance. Lengthy contracts would again contribute to increase contractors interest in road maintenance, but they would also (a) provide more homogenous maintenance conditions over time, and (b) bring flexibility during contract execution (especially in relation to budget freezes); and

(iv) a standard bidding document was prepared for the bidding of rehabilitation and maintenance services contracts (most road administrations did not have standardized bidding documents at that time) to reduce time required by road administrations in preparing individual bidding documents and by the General Attorney's office in reviewing such documents.

Contributing to increase accountability on the contractors' side

(i) rehabilitation works and maintenance services were included in the same contract, with rehabilitation works to be executed in the first part of the contract,[10] and maintenance services to be undertaken over the contract's entire duration. Contractors, accountable for maintenance of the road on the long run, would thus have incentive to execute works in a qualitative fashion;

(ii) contractors were made accountable for the quality of the road condition, with payments linked to the performance (measured by specifically designed indicators[11]) in the delivery of the output both for maintenance services and rehabilitation works, rather than payment for quantities of material and services inputs. Financial penalties were, in particular, designed to punish the partial performance (or non-performance) on the agreed services; and

(iii) contractors, selected under a bidding process including technical specifications based on preliminary design, were in charge of the preparation of the detailed design to be presented to the road administration for approval prior to undertaking the works. Optimized technical solutions to the observed defects were thus expected to be proposed by contractors committed in the long run.[12]

[10] 3 to 4 years at maximum in the CREMA, 1 year in the case of CREMA *1a Etapa*
[11] See more details in paragraph 22 in Section I, Section III on lessons learnt and annexes 5 and 6.
[12] The more recent contracts, though, are now bid on the basis of detailed, albeit simplified, engineering designs (see section III on lessons learnt)

Fostering increased credibility in the sector

(i) contracts overall management was both eased and improved at all steps of the project cycle through the above streamlined (and simplified) procedures, that is the production of standardized engineering designs, the bidding following standard processes and the simplified contract monitoring, by output rather than inputs. The reduced number of biddings and contracts as well as a quality control based on audits of the contractors' internal quality management processes, also contributed to simplify the program management by the administration;

(ii) risk of disputes during contract execution was dampened thanks to: (a) contractors' involvement in both rehabilitation and maintenance phases and in the long run, (b) contractors increased accountability on quality, and (c) contract execution monitoring based of the evaluation of performance in delivering outputs, rather than on detailed evaluation of specific quantities of inputs (subject to numerous disputes notably on quantities and processes of execution); and

(iii) maintenance and rehabilitation programs monitoring were also improved via the design (and publication) of regular reports objectively consolidating physical and financial progress. Such reports fostered the road administrations' capacity in identifying implementation issues and proposing remedies, and contributed to increasing the transparency on their activities vis-à-vis the governments and civil society.

D. CREMA contracts' technical and operational features

20. The following sections focus on the description and evaluation of Brazil's most widely spread application of the performance based model for the road sector, the CREMA contract. Other applications range from performance based maintenance to performance based contract for maintenance and functional rehabilitation (such as the CREMA 1a Etapa). These modalities, described in section II.C. below and Annexes 8 and 9, use some of the CREMA features described below.

21. CREMA contracts include services and works organized in 4 subcomponents:

(i) initial ***deferred maintenance*** (recuperation) services, to be completed in the first 6 to 12 months of the contract to address the most pressing needs and maintenance backlog, particularly in terms of traffic safety and prevention of further deterioration of pavements;

(ii) routine ***maintenance services***, to be carried out until the end of the 5-year contract to maintain the roads, including pavements, structures, drainage, signaling systems and right-of-way in accordance with specific level of performance measured through specific indicators;

(iii) ***rehabilitation works***, to be completed within a specified period of up to 4 years, [13] to recover the structural and functional characteristics of the roads, including pavements, drainage and signaling systems;

(iv) ***limited improvement works***, generally designed to improve traffic safety and reduce existing environmental liabilities within the roads' right-of-way.

22. The performance monitoring system has been designed to ensure that maintenance is appropriately executed during the contract's full duration. Initially based on more than 100 indicators in the first CREMA, it has been simplified over time to ease monitoring.[14] Likewise,

[13] 3 years in the more recent CREMA
[14] See description of monitoring system in annexes 5 and 6.

the sanctioning system based on financial penalties defined to reflect the seriousness of the observed defects[15] has progressively been simplified (see Section III on lessons learnt).

23. Contracts are awarded to the bidder offering the lowest global price, which is composed of: (a) the sum of the fixed monthly installments[16] proposed by the bidder for the initial recuperation (during the first 6 to 12 months) and the maintenance services (during the 48 to 54 remaining months), and (b) contractors' lump sum price for both rehabilitation and improvement works as defined in the design. Lump sum CREMA contract is structured to tighten the possibility of any addendum, unless very specific events occur such as drastic change in the contract conditions (for example, traffic increase by more than 30 percent).[17]

24. Invoicing by the contractors, and payments by the clients, are to be issued on a monthly basis under the following arrangement: (a) for the initial recuperation and the maintenance services, the agreed installment corresponding to an even distribution during each phase duration (that is 12 months for initial recuperation and 48 months for maintenance) of the portion of the contracted global price allocated to each service, taking into account eventual penalties; and (b) for the rehabilitation and improvement works, per kilometer of technical solution and unit of work improvement executed in accordance with the detailed design,[18] Brazil construction norms and the respect of rehabilitation performance indicators, also taking into account eventual penalties.

[15] for example, occurrence of potholes on the pavement would result in higher fines than cracks on shoulders

[16] These installments are expected to cover contractors expenses to comply with the maintenance performance indicators set in the bidding documents over the full contract duration

[17] New CREMA strengthened rehabilitation and regularly updated solutions toughen even more the possibility of any addenda.

[18] Executed by the contractors in the first CREMA, provided by the administration on the more recent CREMA

II. RESULTS TO DATE

A. An overall satisfactory execution

25. The performance based model adopted in Brazil introduced a number of radically new features as regards traditional management of contracts in the road sector in Brazil, including:

(i) lump sum/global prices contracts, instead of classic detailed input-based contracts, with an important transfer of responsibility in the design and execution of rehabilitation works to the contractors;

(ii) a remuneration based on contractors' performance to achieve predetermined outputs, instead of inputs admeasurements (means and material); and

(iii) an increased commitment of contractors to quality through self-control in line with the ISO philosophy, instead of an Employer-led control.

26. The implantation of this rather "revolutionary" approach in the Brazilian context required important efforts of adaptation on both the public/client and private/contractor sides. Such adaptation took place in a gradual fashion, with a relatively lengthy process (close to a year) to structure the first bidding documents and related technical norms. At bidding stage, private sector reaction to CREMA in the state of Rio Grande do Sul was adequate. Reaction in a first round of bidding at the federal level was less successful and inadequate proposals warranted the re-bidding of the first CREMA contracts.

27. The execution of the first CREMAs both in the state of Rio Grande do Sul and at the federal level revealed also a number of weaknesses, which have been gradually corrected in follow-up CREMA contracts. The overall process of preparation, bidding and execution of the first CREMA contracts resulted in a number of valuable lessons, which were taken into account in structuring and bidding follow-up performance based contracts (see section III below on lessons learnt).

28. Beyond these initial difficulties, ***the execution of CREMA contracts has been satisfactory.*** As detailed in subsection B below, the appropriation of the CREMA by the private sector has finally been successful with: (a) high level of competition at bidding stage, with in average 14 competitors per bid and average discount relative to the engineering designs estimates of 21 percent, in line with situation observed for traditional contracts; and (b) overall better road conditions obtained at lower costs in CREMA than in contemporaneous traditional rehabilitation and maintenance contracts.

29. In addition, discussions between the governments and the Bank on the basic concepts for performance based contracts led to the introduction of a series of other improvements in road maintenance and rehabilitation practices, including:

(i) the contracting of design and supervision services in single contracts, to increase consulting firms' commitment to providing quality engineering designs, poor design being a recurrent issue for a number of road administrations in Brazil;

(ii) the structuring and regular publication of the first set of comprehensive physical and financial progress reports for public investment programs in the road sector in Brazil, to allow better monitoring of contract performance;

(iii) a gradual consolidation and modernization of information systems supporting contract management, to provide relevant data for monitoring of investment programs on a regular basis, as the information systems previously used by the public administrations in Brazil were mostly focused on tracking use of budgetary allocations; and

(iv) a gradual streamlining and standardization of processes used for preparation and evaluation of engineering designs and for bidding of civil works (with, for example, the emergence of standard bidding documents for contracting of civil works in road administrations).

30. Finally, the relative success of CREMA contracts to date allowed for a substantial increase in the government's commitment to road maintenance and rehabilitation, traditionally neglected among road investment programs. In particular, discussions at the federal level led to the detailed formalization through a decree of the Ministry of Transport on a road maintenance and rehabilitation program (called the PRO-CREMA program), a first in the road sector in Brazil, where programs are usually defined in an informal fashion. The decree,[19] the result of a series of technical discussions between the Ministry of Transport representatives and the Bank, clearly spells out the objectives of the program, the basic principles to be followed in the program's structuring and execution, the instruments to be used, as well as the targets to be achieved.

B. Comparing CREMA efficiency versus traditional approach

31. This section presents an ex-post comparative evaluation of the CREMA contracts completed so far, relatively to contemporaneous traditional contracts, on the following parameters: (a) contracts costs, (b) road conditions after contracts' execution, and (c) impact on workload for the executing agency. The methodology developed for the purpose of the present analysis focused on evaluating the contracts' measurable characteristics, taking into account data availability at the time of the evaluation in an opportunistic fashion and in the least possible biased way,[20] so as to turn the comparative evaluation the most objective possible. The resulting comparative evaluation, which methodology is further detailed in Annexes 1 and 2, is deemed to give a fairly good evaluation of CREMA overall compared efficiency versus the traditional approach, considering the assumptions and limits detailed below.

32. For comparison purposes, it was assumed that CREMA and traditional rehabilitation and maintenance contracts were:

(i) used to resolve the same nature of problems (that is, each contract could have been indifferently used when tackling the road deteriorations);

(ii) subject to the same contract management capacity by the administrations, as well as the same budgetary constraints; and

(iii) executed by contractors with similar capacity.

33. Factors constraining the analysis included:

(i) the use of average data in the comparison may have hidden specific situations, notably as regards costs and road conditions;

(ii) on the other hand, the universe of comparison remained relatively small: the marginal impact of one deviation from averaged values may not have been negligible;

(iii) the comparison was limited to certain quantitative data available at the time of the study.[21] Thus: (a) it was not possible to compare the contracts' impact on the structural condition of the road sections (the last deflection survey was undertaken in the early 2000s) nor the impacts on traffic safety, due to absence of relevant statistics in Brazil; and (b) no qualitative comparative evaluation was possible (no users satisfaction surveys were available nor programmed by the time of the study); and

(iv) as a result, undertaking a full life cycle cost comparative evaluation of CREMA vs. traditional approaches was not possible in the context of the note, notably due to the difficulty to systematically and objectively evaluate the expected remaining life of the infrastructure at the end of each contract.

[19] Decree #7 (2008) - http://antigo.sicepot-mg.com.br/PortariaN7MinisterioDosTransportesJan2008.html
[20] Both CREMA and traditional approach have coexisted under contemporaneous contracts in Brazil and road conditions have been objectively evaluated at the end of CREMA cycle of execution.
[21] In particular, undertaking specific field surveys was clearly beyond the scope of the present note.

B.1 Comparison of costs

34. The comparison was comprised of 15 CREMA, 74 traditional rehabilitation contracts and 13 traditional maintenance contracts. The main conclusions of the analysis, further developed in Annex 2, are summarized below.

(i) Independently from the type of contracts, unit costs per km as well as technical solutions used presented *substantial variations*.

This is a natural consequence of the variety of situations regarding road conditions, rehabilitation needs and executed solutions.

(ii) When limiting the comparison to contracts bid around the same time, *average discounts* proposed by bidders relative to the engineering design estimate, have been in similar ranges, at 21 percent for CREMA against 16.5 percent for traditional rehabilitation contracts.

Levels of discounts during the period 2000-2005 were high notably due to high competition among contractors[22] for a fairly small number of new public works contracts (notably given the severe fiscal adjustment Brazil was undergoing[23]). The similar discount value for CREMA as for the traditional rehabilitation contracts also meant an adequate understanding and appropriation of this new contract modality by the construction industry.

(iii) Addenda in the conventional rehabilitation *increased the contract value* above the original contract costs by approximately 17 percent, more than twice the average 7.1 percent increase in the case of CREMA. Given the addenda, traditional rehabilitation *final contract values* had increased such that they generally equaled the initial estimates for contracts signed in 2000-2005 (or even exceeded them in average in the long run), whereas in comparison, *CREMA final values* averaged 14.5 percent lower than the initial estimate.

The use of CREMA thus increased efficiency in contract management, allowing to significantly curb contract price increases usually observed under traditional rehabilitation contracts, where contractual modifications provide opportunities to increase the prices. Both the contracts' lump sum nature and tighter management of the program by the road agency played important roles in fostering such distinctions.

(iv) CREMA rehabilitation unit cost of works have been 25—35 percent lower than traditional rehabilitation costs signed at the same period (depending on the sample considered) and maintenance unit costs have been 34 percent lower than the conventional maintenance unit costs.

CREMA lower rehabilitation costs are coherent with (a) the above limited number and value of addenda during contract execution and (b) the use of lighter solutions than in the traditional rehabilitation contracts. The lighter solutions (as measured by the indexes designed for the purpose of the analysis and presented in Annex 2) were in line with the projects' 5 years service life design, shorter than the usual 10 years life design for traditional rehabilitation.[24] CREMA maintenance cost was cheaper as it was more regular and focusing on preventive, rather than curative actions (see subsection B.2 below). Economies of scale gained from larger and better coordinated contracts may also have contributed to the above differences.

It is worth highlighting though, that neither the use of lighter rehabilitation solutions nor cheaper maintenance were detrimental to the road conditions. On the contrary, as shown in subsection B.2 below, CREMA eventually presented better conditions than the traditional approach.

(v) CREMA final unit costs over a full 5 year rehabilitation and maintenance cycle has been 19 percent lower than the rehabilitation and maintenance cumulative costs

[22] 13.7 bidders per bid in average on 17 CREMA bids
[23] Average discounts consented on a 10 years period (1998-2008) are lower, at around 2 percent
[24] More recent CREMA are also based on 10 year design solutions

on the 13 identified roads at the federal level benefiting from separate contracts for rehabilitation works and maintenance services afterward (see summary of the Annex 2 results in the Table 3 below). This was achieved without significant differences in terms of road surface condition at the contract end (see *subsection B.2* below);

It is worth noting that under the traditional approach (a) many rehabilitated road sections were never followed by routine maintenance contracts and (b) when it occurred (in the above sample), an average gap of 2.7 years between the end of the traditional rehabilitation contract and the beginning of the traditional maintenance contract had been observed. This break in servicing the road, resulting from difficulties of most road administrations in planning, bidding and financing civil works contracts, has not been observed under CREMA.

Table 3. – Full rehabilitation and maintenance cost cycle comparison

	Final Contract Values (R$ / km - June 2008 Values)						US$ / km
Yrs	1	2	3	4	5	Total	Total
CREMA - 5 years cycle							
Type of	CREMA - 5 yrs						
Rehabilitation	187,338					187,338	91,384
Maintenance	8,389	8,389	8,389	8,389	8,389	41,947	20,462
						229,285	**111,846**
Conventional rehabilitation and maintenance - 5 years Cycle							
Type of	Rehabilitation			Maintenance			
Rehabilitation	256,604					256,604	125,173
Maintenance				12,974	12,974	25,948	12,658
						282,552	**137,830**

Sources DNIT and the World Bank

B.2. Comparison of road conditions

35. The road surface condition was measured using the international roughness index (IRI) and the Brazilian IGGE index,[25] for which data were collected in 2007,[26] a date which corresponded to the end of the implementation period for the first CREMA executed at the federal level.

36. For the purpose of the evaluation, the federal roads covered by the contracts have been split in sections presenting (a) homogenous conditions in terms of each of the two indexes, and (b) similar contractual characteristics, both in the nature of the contract and state of execution at the moment of the evaluation (for example, a contract at an early rehabilitation stage at the moment of the evaluation would be excluded). Weighted averages of both indexes have been calculated and summarized in Table 4 for a sample of roads which were rehabilitated between 2000 and 2005 (detailed results are presented in Annex 1).

Table 4. – CREMA vs. traditional rehabilitation IRI / IGGE comparison

	CREMA		Rehabilitation	
Total Extension (km)	4,110		4,250	
	IRI	IGGE	IRI	IGGE
Weighted average	3.03	25.02	3.09	49.19
Standard deviation	0.8	14.85	1.28	44.43

Source DNIT and the World Bank

37. This network evaluation was then completed on a contract by contract evaluation on a set of road sections covered by CREMA on one hand, and on the other hand, road sections

[25] The Brazilian IGGE, *Indice de Gravidade Global Expedito*, is a composite index based on the main visual distresses usually observed on the roads. Conditions vs. IGGE values are given in the Annex 1.
[26] For the first time since 2001.

covered by similar works and services following the traditional approach that is with (a) rehabilitation works executed between 2001 and 2005 and (b) afterward maintenance services. 26 cases presenting these similarities were identified, including 13 CREMA and 13 traditional rehabilitation (followed by traditional maintenance) contracts.

38. The evaluations (detailed in Annexes 1 and 2) show that:

(i) Overall, average conditions of the road sections covered by CREMA and traditional contracts, on more than 4,000 km each, executed in the past 6 years, are relatively good.

This demonstrates that both contractual instruments have been effective at improving road surface condition. Road surface conditions are notably similar when measured using the IRI.

(ii) Homogeneous road sections which had been served by CREMA presented more even conditions than the road sections with traditional rehabilitation (as shown by the respective standard deviations in Table 4).

This can be explained by an increased homogeneity of technical solutions at the program level and overall improved maintenance in the case of CREMA (see (iii) below).

(iii) When measuring road surface condition using the IGGE index, CREMA contracts, with an average value of 25 (an index value considered very good), have been more efficient than traditional contracts, which present an average index value of 49 (an index value considered regular).

Road sections under CREMA benefited from a more regular and focused maintenance over a 5-year period: on the sample of 74 road sections rehabilitated with the traditional approach between 1998 and 2008, the average gap before the start of maintenance services following the end of rehabilitation has been more than 4 years. Only 15 of the above rehabilitated sections have received maintenance services within one year of the rehabilitation completion and, by the end of 2008, 1/3 of these road sections covering more than 5000 km still had not received any maintenance. In comparison, maintenance has been executed in a relatively regular fashion in the CREMA during the 5 year contract duration.

(iv) When limiting the comparison to roads having benefited from both traditional rehabilitation and follow-up maintenance services (13 road sections totaling 1770 km, including 935 km rehabilitated), differences in road surface conditions are attenuated, though the comparison is still slightly favorable to CREMA (see Table 5 below and details in Annex 2).

This illustrates (a) again, overall improved maintenance in CREMA, naturally more focused on preventive than curative (and more costly) actions, (b) improved coordination of rehabilitation works and maintenance services in CREMA[27] without laps of absent maintenance, and (c) an improved suitability of the rehabilitation interventions in the CREMA (see point (v) below).

(v) Per contract, the mix of technical rehabilitation solutions used has been more diverse and the length of rehabilitation works shorter in CREMA than in the traditional approach.[28]

The contractors seem to have more finely calibrated their interventions by optimizing the distribution of the works (both in nature and size), bringing "intelligent customization" of the interventions to the needs in the road management and increasing efficiency in execution of civil works.

[27] An average gap of 2.7 years has separated the end of the rehabilitation works from the beginning of the maintenance services, and maintenance services covered a network extension twice as large as rehabilitation works.

[28] As reflected by the indexes of variability and dispersion calculated in Annex 2.

Table 5. – CREMA vs. traditional contracts compared conditions at contract end (limited to rehabilitation contracts followed by maintenance contracts)

CREMA			Traditional rehabilitation		
Length	IRI	IGGE	Length	IRI	IGGE
4,249.5	3.02	22.87	935.4	3.41	32.22

B.3. Impact on executing agency workload

39. Undertaking a quantitative impact analysis of the executing agency workload in managing CREMA and traditional maintenance and rehabilitation contracts would be a long and complex exercise, the difficulty of which would be further compounded by the absence of analytical accounting systems in the public sector in Brazil. Besides, it would be well beyond the scope of this paper. However, CREMA contracts present, by design, obvious advantages over traditional contracts, allowing a reduced workload for the executing agency. In particular,

(i) *At the programming and bidding stages*, maintenance services seamlessly followed rehabilitation works, without any need for the executing agency to specifically plan the intervention or prepare specific bidding processes for contracting maintenance services. In addition, the road extension covered under CREMA contracts has been, on average, 4 times longer than under traditional rehabilitation (2.5 longer than maintenance contracts) and more than twice the usual duration for traditional rehabilitation (1.5 to 2 years) and maintenance (1 to 2 years).

It was assessed that the rehabilitation and maintenance of the 5,000 km executed under CREMA between 2001 and 2006 had reduced the number of biddings by a factor of 7 when compared to what would have been needed in the traditional approach. This, in turn, reduced workload on procurement units and contributed to improving the quality of procurement processes as larger contracts (such as CREMA contracts) were bid by the executing agency headquarters, which were more experienced than the agency's decentralized units.

(ii) *At works and services' execution stage,* contract supervision has been eased thanks to CREMA's monitoring of the performance in executing the task (kilometers of completed rehabilitation works and quality of service for maintenance) and auditing of contractors' quality assurance processes. These are much less time intensive and cumbersome than the traditional processes required for verifying detailed quantities of inputs (classic bills of quantities are usually composed of up to several hundred inputs including material, transport distances, activities and services, and so on).

This has, in turn, contributed to reducing the number of administrative supervision procedures (for example, technical double checks of invoiced quantities at the decentralized unit and at headquarters, limited calculation and/or transcription error corrections, reduced conflicts with contractors on quantities and qualities of inputs, and so on).

40. While the above evaluation is merely illustrative, it nevertheless points to the fact that the evaluated CREMA contracts were generally more efficient than traditional contracts. In particular, CREMA:

(i) allowed contractors to customize their interventions, optimizing the nature of rehabilitation works and their timing of execution;

(ii) shift contractors' and executing agencies' focus from curative, more expensive interventions to preventive, low-cost interventions;

(iii) decrease administrative burden on the executing agencies; and

(iv) provided better results to road users at lower cost.

C. Other federal applications of the performance based model

41. At the peak of the fiscal adjustment period in 2002/2003, when works under the first CREMA contracts were initiated on 10 percent of the federal network, a new and expectedly more agile application was tested at the federal level in the form of a "lighter" CREMA contract (called initially *Creminha*, then *PIR IV*, and now *CREMA 1a etapa*). The contract's main characteristics included a functional recuperation of the pavement in the first year and routine maintenance during the entire two years contract. Payments were based on admeasurements for the recuperation phase, and performance (monitored on the basis of a simplified set of indicators) for the maintenance. Contract extensions averaged 130 km to 160 km and unit costs of recuperation were less than half of the CREMA's rehabilitation unit costs.

42. Characterized by simplified preparation and easier (and less costly) execution, it was designed in a relatively pragmatic fashion as a temporary urgent response to prevent the network conditions from further deterioration in the budgetary constrained context at the federal level. The CREMA *1a Etapa* was seen as a good instrument to address, at least temporarily, the road's most crucial problems (generally resulting in traffic safety issues) on a substantial part of the federal network, and prepare for the execution of more sustainable rehabilitations of the roads in the form of fully fledged CREMA contracts.[29]

43. Early results showed that the use of CREMA *1a Etapa* contracts allowed a significant improvement in the efficiency with which maintenance and rehabilitation contracts have been traditionally managed: (a) since 2002/2003, 110 contracts totaling 15,720 km have been successfully executed, (b) another group of 80 contracts totaling 10,230 km (close to 20 percent of the federal network) are currently underway, and (c) in 2008, the DNIT (National Department of Transport Infrastructure) had managed to prepare the designs of 25,000 km of CREMA *1a Etapa* contracts and was preparing to contract those works before the end of 2009, far beyond the entity's historical capacity averaging 3,000 to 4,000 km of road rehabilitation new works per year. In parallel, preparation of engineering designs under the PRO-CREMA program (aiming at launching 7,500 km of CREMA contracts per year, see paragraph 2 above) was progressing slowly.

44. The increase in management efficiency in using CREMA *1a Etapa* contracts notably has stemmed from the further simplification of the contracts' preparatory activities: the preparation of design has been based on further standardized and simplified models, executed in a centralized fashion (for economies of scales), and if possible, in-house (with eventual support from supervision consultants for the data collection and program manager consultant for the data analysis). Projects have usually been executed in less than 6 months (against usual minimum 18 months in other contracts), at an evaluated cost of 3 to 5 times less than the usual costs of preparation for such projects.

45. An in-depth evaluation of the CREMA *1a Etapa* efficiency comparison was not possible in the framework of the present note due to the lack of adequate comparators and availability of relevant data: these contracts constitute a mix between CREMA, traditional rehabilitation and traditional maintenance contracts; and a lag of 2 to 3 years has often occurred between the end of these contracts and the last road network condition evaluation, in 2006-2007. Overall though, they have played a positive role in the recent improvement of the condition of the federal paved road network, which can be assessed in light of the average conditions of the roads which were covered by these contracts: with IRI and IGGE at average levels corresponding to roads in regular condition, these 10,000 to 15,000 km of roads have been kept in much better condition than the rest of the network (Annex 1).

[29] Design and bidding of CREMA, then called *2a Etapa*, were in particular expected to take place during these contracts' execution.

III. LESSONS LEARNT

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

Box 2. Status of performance based contracts on various road networks in Brazil

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

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

A. On strategic orientation

Particular adaptations of the performance based model to local specificities is a fundamental process to ensure adoption of the model and full ownership

48. This may imply that: (a) mistakes already made in the past may reoccur in new places because not all lessons can be applied uniformly to all cases; and (b) basic concepts and processes need to be adapted to meet specific needs. In particular, at the federal level, deficiencies in maintenance and rehabilitation planning and programming, combined with difficulties in contracting and reviewing engineering designs following traditional processes, led to the emergence of two-year performance based contracts including maintenance services and light rehabilitation works, the CREMA *1a etapa*, as a palliative measure to maintain road conditions until CREMA contracts could be launched (see above subsection II.C.). The experience has proved successful, especially in terms of efficiency gains in managing such contracts.

49. In its actual form, though, CREMA *1a Etapa* contracts remain a temporary solution and in order to fully take advantage of all the potential benefits of the performance based approach,[30] CREMA *1a etapa* contracts should a) progressively be substituted by fully fledged

[30] Such as: quality and sustainability of the road conditions improvements, effective transfer of accountability to committed contractors on the medium to long term, reduction of burden on the administration and so on.

CREMA contracts, and/or b) reinforce the rehabilitation's technical solutions to ensure more durability of the works, and extend contracts' duration to a minimum of 4 to 5 years.

A contractual instrument should not be considered as a silver bullet to try to resolve a whole host of contract management issues

50. At the time the first CREMA contracts were designed, road executing agencies were notably concerned with: (a) forecasting the likelihood of payment requirements flows under works contracts to ensure more timely payments (in a context of very limited budgetary allocations for road investments); (b) increasing timeliness and quality of engineering designs; and (c) decreasing occurrences of price addenda. Unfortunately, an efficient resolution of such management issues cannot be solely left to a contract model and requires as well improvements in management capacity of the road agencies. Indeed:

(i) ***Efforts to improve payments predictability*** led to the establishment of monthly payment limits for rehabilitation works (limits established at bidding stage), regardless of the possible evolutions of the operational conditions on the field. Experience has shown that contractual monthly payment limits did little to improve executing agencies' capacity to improve payment timeliness, but it was felt by the contractors as yet another impediment to efficiently execute the contracts, and was going against the principle of increasing contractors' accountability and decision-making power. Contractual payment limits were thus later dropped.

(ii) ***Efforts to increase timeliness and quality of engineering designs***[31] led to bidding the contracts based on preliminary designs, leaving the responsibility to the contractors to present final designs for review by the executing agencies. Such a strategy apparently presented a number of advantages, including: (a) high capacity for design production at low cost within short periods of time, thus increasing program flexibility and projects' coherence between the *in situ* conditions and the design's remedial solutions, and (b) increased accountability of contractors towards quality, expected to potentially result in less conflicting contract execution. However, while basic designs could be prepared quite efficiently through consulting firms contracted by road executing agencies, contractors were required to, following works contract signature, hire engineering firms to finalize the designs, which added to the contractors' costs and generated delays. Furthermore, road executing agencies were slow at reviewing and approving the final designs, which generated additional delays. Eventually, some contractors showed a tendency to select lighter rehabilitation solutions in preparing the final designs, with possible implications for the medium-term sustainability of the works. In follow-up CREMA contracts, it was decided to base biddings on simplified designs, the execution of which would be compulsory (see paragraph 54 below).

(iii) ***Efforts to decrease price addenda occurrence*** led to the adoption of lump-sum contracts including proportion (that is, sub-lump-sums) fixed upfront for each one of the four types of CREMA activities (initial recuperation, rehabilitation, maintenance and improvements). This fixed contractual structure was unable to decrease occurrences of price addenda and moreover, resulted in incentives given to the contractors to do the minimum to meet the contracts' performance and quality indicators. In addition, experience showed that a number of price addenda were not the contractors' fault but resulted from: (a) contracts stop and go's resulting in the roads' further deteriorations, as payments to contractors were quite irregular during the 1999-2004 period; and (b) the difficulties faced by the road administrations in obtaining budgetary resources for new civil works contracts at the end of the running contracts and in timely preparing and bidding these new works, which, in turn provided an incentive to road administration to

[31] Usually around 18 months are necessary between bidding and completion of engineering designs, and another 18 months between bidding and contracting of civil works. By the time the civil works are executed, at least part of the engineering designs is outdated.

include additional works in existing contracts. Finally, provisions included in the first CREMA contracts to minimize potential justifications for modifications to work design during contract execution did not prove useful, as the number and scope of modifications have been similar in the CREMA as in the traditional contracts.[32] Follow-up CREMA contracts were kept on lump sum basis, though detailed by globalized price per solutions of rehabilitation (see paragraph 54 below).

51. In fact, CREMA experience in Brazil showed that under performance based contracts, contractors needed to have sufficient flexibility to determine an optimized mix of technical solutions or/and an optimized execution schedule, without undue interference from the Employer.

Increasing contractors' accountability on the performance has been achieved on maintenance services but remains limited on rehabilitation works

52. First, while good performance indicators have been found for maintenance services, no sufficiently reliable indicators have yet been found for rehabilitation works: indicators like IRI, deflection or IGGE[33] are not sufficiently reliable to make them pass/fail criteria for quality of rehabilitation works. In addition, the data collection efforts necessary to determine the value of these indexes are costly, usually left to the contractors, and, if not, require the contracting of a consulting firm, a usually long process. However, to date, other indicators have yet to be proposed for measuring performance in rehabilitation works, a clear limitation to the possibility of increasing accountability of contractors under a 5 years contract.

53. Second, experience under the first CREMA contracts has shown that the environment in Brazil is not yet conducive to leaving the preparation of final designs for rehabilitation works to contractors under public investment contracts (see paragraph 50 above), another limitation to increasing accountability of contractors.

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

(i) ***Recent performance based contracts are tendered on quality detailed engineering designs*** (though standardized and simplified) on the basis of strengthened technical solutions. Projects, systematically updated before bid, are to be followed by the contractors, unless an unexpected event radically changes locally the *in situ* conditions. Reinforced solutions are expected to (a) compensate for eventual delays in works bidding, (b) accelerate the initiation of the rehabilitation works,[34] (c) reduce the potential conflicts with contractors during the maintenance phase, and (d) ensure sustainability of the rehabilitated road sections, notably in the case that by contract end, new budgetary cuts do impact negatively road maintenance.

(ii) Likewise, ***globalized prices per solution of rehabilitation were adopted*** on recent performance based contracts to increase flexibility in the contract management: the contractors are now paid by km of lane of the solutions executed in accordance with the detailed engineering design. Rehabilitation works, to be accepted, need to be executed according to the existing *corpus* of norms and are further evaluated by two performance indicators: the roughness and the deflection. Globalized prices present also the advantage to ease the definition (and

[32] Analysis of requests for modifications of technical solutions shows that such requests have often been justified on the basis of low quality and/or outdated designs, and/or grounded on the emergence of new, more adequate technical solutions (such as when contractors acquired recycling apparatus).
[33] These indicators, some of which are subject to large variations depending on external factors (for example, deflection), do not trigger appropriately the performance at the end of rehabilitation works phase.
[34] Rehabilitation works now start at contract signature (instead of with one year delay) and are requested to be terminated within a 3 year period.

negotiation) of eventual addenda, which shall however, remain strictly limited to the occurrence of compensation events. In such cases, the same discount to the engineering design estimate as the discount given by the contractor at bidding stage to any alternative and/or new solutions would be applied under the addendum. These, together with a closer supervision of contract execution, are expected to contribute to decreasing the occurrences of price addenda.

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

55. Looking ahead, the above limits in transferring accountability to contractors when it comes to rehabilitation works may be gradually lifted, through a series of evolutions in the contract approach, including: (a) extended contract duration beyond 5 years (see section IV below) to match at least the rehabilitation works service life (10 to 15 years), (b) reliable performance indicators for rehabilitation works (the introduction of indicators based on roughness and deflections at the end of the rehabilitation works in the more recent CREMA is not yet considered a *panacea*), and (c) an appropriate mechanism to ensure the preservation of the road assets during the whole contract duration, particularly by contract's end.

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

56. While project management capacity of road agencies in Brazil is generally weak, experience under the first CREMA showed that strengthened project management was key to further improvements in CREMA efficiency. Road administrations, to be fully accountable for their decisions, need in particular to be strengthened technically and managerially to be able, during the whole contract duration, to (a) produce quality designs of works which are economically justified, (b) be a force of proposal in the discussions of technical options that may arise in the course of the contract execution,[35] (c) objectively supervise works and service quality and performance, and (d) enforce private sector obligations.

57. Experience has, in particular, shown that supervision, while less intensive in terms of volume of data to be analyzed in the CREMA case, needs to be more independent and fully focused on quality. In the case of the DNIT, where such supervision could have overloaded the agency supervision usual capacity, a reinforced supervision has been set up to support DNIT supervision of performance based contracts: it is composed of one consulting firm to support overall contract management and 10 regionalized supervision firms doted of their own laboratories and capacities to support the administration in independently monitoring works and services performance execution. In addition, under an ongoing experiment (see paragraph 59 below), the supervision firms are in charge of collecting road condition data, based on which the contract management firm prepares simplified engineering designs for future rehabilitation and maintenance contracts.

B. On operational options

Simplified designs have proven to be key in improving efficiency of contract management and execution

58. Designs for performance based contracts have been based on solutions deriving from an approved catalogue of standard technical solutions (see example in Annex 7) and standardized (as well as simplified) presentation of designs. Relatively to traditional engineering designs, simplified designs, which are cheaper, are well adapted to design simple civil works such as road rehabilitation. The rationalization gained through clear guidelines on "how to" (typology of field data, methodology of investigations and modalities of presentation) and "what to" (proposed solutions guided by the catalogue) helped both (a) the designers in producing quality design and (b) the administration, easing the process of project revision.

[35] Technical solutions may, in particular, evolve together with conditions during the 3 year period for works execution

Simplification of design is achieved without impacting design quality, notably in cases of delays in works execution, given the broad range for given solutions.

59. At the federal level, an experiment is underway with simplified designs prepared in a streamlined fashion, with data collected by consulting firms in charge of the supervision of ongoing works and designs prepared by a central management consultant (see paragraph 57 above). Involving consultants in charge of the supervision at the design stage is expected to increase consultants' commitment to the designs' quality. The experiment has yielded good results so far, with the preparation, over a 6-month period, of close to 25,000 km of simplified designs for 2-year performance-based contracts for maintenance and rehabilitation (see paragraph 45 and 57 above).[36] Such a modality for preparation of designs could be perfectly used in the preparation of full-fledged CREMA (as was initially envisioned).

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

60. The execution of the first CREMA contracts revealed that the monitoring system envisioned for the occasion was too complex to be appropriately used by road executing agencies (even with consulting firms' support) and thus was not seen credible by contractors. The initial monitoring structure included 99 indicators (11 for work program and 88 for maintenance services management), each one associated with particular performance standards, allowed response time to correct the problems, and amounts and rates (per day, week, month and so on) of penalties in case of non-compliance.

61. The monitoring structure was substantially simplified in follow-up CREMA contracts, and is now down to 11 to 16 indicators for maintenance (depending on it being CREMA *1a Etapa* or CREMA *2a Etapa*) and 2 indicators for rehabilitation. Some maintenance indicators have become stricter[37] and both the monitoring procedures, now exercised on the basis of random technical audits,[38] and the procedures for correction of defects and penalties (see paragraph 62 and 63 below), have been simplified.

The sanctioning system for non-compliance with performance indicators needs to be workable

62. The introduction of financial penalties for non-compliance with specified indicators was a complete novelty in civil works contracts, and an attempt to make contractors more accountable for the services they provide. Penalties were introduced initially as fines, which was a mechanism too unfamiliar both for the public and the private sectors (very few notifications were ever made and payments of fines have been even rarer).

63. Penalties are now made through payment retention from the monthly installments to be made to the contractors. For maintenance, the retention is a predefined portion of the payment related to a specific performance standard (the retention, cumulative per indicator, is weighed proportionally to the evaluated seriousness of potential consequences resulting from unmatched performance[39]) whenever the standard is not achieved. For rehabilitation, payments are made per kilometer when both indicators on roughness and deflection are met. In other words, the contractor is now paid only for the part of the service for which it has performed.

CREMA contracts should exclusively focus on road rehabilitation and maintenance

64. In its actual form, CREMA program's overall efficiency relies on the simplicity of the activities executed under the contracts, focus on simple road rehabilitation works and maintenance services, and streamlining of their preparation, execution, monitoring and managing. As such, it is not an adequate instrument to undertake complex civil works (for

[36] While designs for such contracts are easy and rapid to prepare, it would be the first time that the DNIT succeeds in producing such a large quantity of designs in such a short period of time, following a well-established process

[37] For example, the indicator on maximum proportion of cracks allowed at the contract's end was in fact only triggering the need for new rehabilitations works in the first CREMA.

[38] In principle on at least 10 percent of the network extension.

[39] For example, the presence of one pothole would lead to a reduction of 20 percent in the monthly installment of the related kilometer, much more than in the case of cracks (5 percent) during routine maintenance.

example, bridge widening) or overly specialized services (for example, weighing platforms for heavy vehicles or road condition surveys).

65. Although road executing agencies are tempted to use CREMA to undertake additional civil works on the road sections covered by the contracts (notably given the difficulties faced by the administrations to initiate new activities), experience shows that in doing so, administrations may hinder the whole program execution as it (a) slows down design preparation, (b) may delay contract initiation (as some of these works may require specific environmental licenses), (c) may slow down contract execution (such works and services are generally not in the core line of work of the contractors and conflicting interfaces may arise between contractors, their sub-contractors and the administration), and (d) often end up not being undertaken. If undertaking such complex works and specialized services is essential, it should be done under specific (though possibly performance based) contracts considering the prevailing context in Brazil.

Longer implementation periods increase contract performance's resilience to budgetary constraints

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

IV. LOOKING AHEAD

67. The execution of the first CREMA contracts has yielded promising results. However, the full potential of using such a contractual instrument is far from having been reached. ***First***, the application of the main lessons learnt to date (and others which still have to be learnt) will allow for gradual efficiency improvements.

68. ***Second***, the federal government and the Bank have initiated discussions on possibly increasing the contract execution period beyond 5 years (the maximum allowed under Brazil's public procurement law) to possibly 10 years or so (following Brazil's Public-Private Partnership law). In order to give such a pilot the maximum chances of success, notably at preparation and execution stages, operational options of such "extended" CREMA still need to be carefully weighed and thinly customized to Brazilian context. The management of these extended CREMA will notably constitute new challenges for the administration, including the management of more complex bidding and the need for a strengthened contract managing capacity. It will require more permanence of competent and experienced staff on the long run, sufficiently credible to stand as relevant interlocutors to contractors when it comes to monitoring the contracts execution.

69. This new type of CREMA may however, bring potentially large efficiency gains in road network maintenance and rehabilitation. Beyond the obvious gains in further reducing administrative workload on road executing agencies, extending the duration of CREMA would allow to further increase accountability and delegation of responsibilities on the contractors' side, in line with the practices for road concessions. It would also further increase construction industry interest in road maintenance and rehabilitation. Finally, it would allow to lock-in, over a 10-year time horizon, government budgetary commitment to road maintenance and rehabilitation,[40] enabling optimal use of public resources even in fiscally-constrained situations.

70. ***Third***, the above desirable evolutions of CREMA towards PPP-like approach should be accompanied by a reflection on how to improve road planning and programming of interventions so as to further improve efficiency of investments in the road sector. HDM (or other equivalent software)[41] supported analysis could foster the preparation of strategies optimizing investments volumes and sequencing, in relation to potential benefits in road and vehicle operation, considering the infrastructure life cycle and eventual budget constraints, with a view to optimizing the management of road assets. In turn, this would constitute the basis to define indicators triggering performance to be attained by contractors on extended CREMA, regarding structural condition of the road, either by contract end, returning the infrastructure to the administration with a minimum remaining service life, or in a dynamic way, all along the contract life. So as to circumvent the operational constraints imposed by the technologies and methods actually available to evaluate road structural conditions (such as time for execution and cost, margin of imprecision to characterize a situation inherent to each measurements and so on), a monitoring system based on the principle of statistic technical audit could be envisioned following methodologies used in PPP in Europe or in the United States.[42] Payments modalities would thus be adapted[43] and contractors would end remunerated for the performance in undertaking the overall road asset management, accordingly to the administration precise requirements, rather than merely executing works defined by the administration.

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[40] Indeed, in most cases, these Private Public Partnerships (PPPs) would not be able to rely on users' fees given the generally low levels of traffic.

[41] See examples of software on: http://go.worldbank.org/I16545KTK0

[42] For example, reasoning in thresholds and maximum populations of measurements allowed to exceed these thresholds.

[43] For example, flat payments during contract execution independently from the volume of works and services and on the other side, internalization of parameters such as evolution of traffic volumes and loading to take into account contract extended time duration in the composition of payments.

71. Efforts in structuring a planning capacity in the road administrations have been continuous in the past years. This has notably translated at the federal level with a strengthening of DNIT human resources, through the recruitment of staff, the setting-up of capacity building programs,[44] and the first evaluations of road conditions since 2001, through field surveys executed in 2007 and 2008. To be fully operational and minimizing shifts in planning and programming of works based on non-technical and economic criteria, this planning and programming capacity yet remains to be consolidated. In particular: (i) actual road condition surveys need to be completed by traffic and road structural evaluations,[45] and governments must be committed to repeating surveys in a systematic fashion along the years, (ii) technical capacity of the staff needs to be further strengthened, and the different units of road administrations need to be further integrated in the planning process (notably delocalized operational units which constitute useful complementary source of information and may support the monitoring of field surveys), and (iii) road administrations need to be endowed of a central role among the governments' agencies and institutions in the initiative, preparation and execution of independent and objective multiyear planning and yearly programming of investments in the road sector.

72. ***Fourth***, the main obstacle to date to generate further significant efficiency gains is the present organization and capacity of the public sector as a whole. The public sector in Brazil, just like in most countries in the world, is organized in a fashion that is not naturally conducive to the introduction of result based management principles. Under such context, shifting public administrations towards result based management requires a lot of political commitment, as illustrated by the successful example of the State of Minas Gerais (see box below). In addition, in order to adapt to such a new management system, (a) planning of public investment would need to be further strengthened to ensure an appropriate articulation of the different programs, and monitoring of investment execution further reinforced; and (b) current information systems almost exclusively geared towards tracking expenditures against budgetary allocations, would need to be modernized to become fully reliable and inclusive in order to allow for meaningful physical and financial monitoring of public investment programs.

Box 3. Minas Gerais experience in result based management[46]

The Administration of the State of Minas Gerais has undergone an important paradigm change under the concept known as Management Shock (*Choque de Gestao*). In 2002, in a context of a dire fiscal situation, the newly-elected government decided to focus a large share of its political capital on improving the quality of public administration. A *State for Result Program* was articulated around the themes of fiscal balance, efficient public management and private sector development. A key component of the program has been the definition of clearer policy objectives, materialized by a set of outcomes, outputs, process improvements and input usage targets.

To align the administration action with these objectives, the government devised a range of new tools for more efficient management. *Autonomy* of the secretariats was partially increased through guaranteed budget resources for priority programs, as well as higher flexibility in staff redeployment. *Accountability* was improved through the introduction of a system of result-agreements at the administrative level, linked with a new system of evaluation for staff. Particularly, program managers' pay became directly linked with the achievement of their own performance targets. In parallel, a robust central system of *monitoring and evaluation* was structured including a quarterly review of results, a regular program evaluation and a series of policy or program design reviews. In the context of a relatively tightly united government team, peer pressure proved efficient to put in question traditional thinking and inefficient *ad hoc* working arrangements. Finally, at the central level, important efforts were dedicated to improving the efficiency of the public procurement, budgeting and financial management systems.

The road sector has been part of the change, with its major investment programs ranked priority by the government. To increase performance, the administration went first for the more easily managed items, mostly at program design. More recently, given the difficulty to achieve all targets within an existing constrained environment, the administration initiated an assessment of the structural adjustments necessary to meet the new centrally managed performance requirements.

[44] Including: training, notably on HDM, creation of a network of professionals in HDM/planning in Brazil at federal and state levels, preparation of a study of calibration of HDM to Brazil conditions.
[45] Though planned for several years, no such survey has been undertaken for the past 10 years or so.
[46] Second Minas Gerais Development Partnership Project, Project Appraisal Document, WB 2008 - http://go.worldbank.org/7HIVHS8IY0

73. ***Finally***, the profile of civil servants in Brazil, again just like in most countries in the world, is one where the administrator has limited accountability for results. This profile would need to shift towards one where the manager has clearly defined responsibilities and accompanying incentives to ensure that large efficiency gains can be achieved in the public sector. In particular, an adequate management of CREMA contracts requires road executing agencies to: (a) be technically and managerially stronger and more independent and responsible to ensure that public interest is preserved; (b) develop a holistic and structured vision for management of road maintenance and rehabilitation, the implementation of which would require profound reforms in areas such as management and organization, human resources, planning, information technology and procurement.

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ANNEXES

ANNEX 1: CREMA AND CONVENTIONAL APPROACH COMPARATIVE EVALUATION – NETWORK LEVEL

1. The first evaluation campaigns of the federal network conditions since 2001 were initiated in late 2006-early 2007. They consisted of a combined evaluation of both the roughness (measuring longitudinal irregularity expressed in m/km following the international roughness index (IRI)), and the visual condition (evaluated by road engineers following a defined norm, expressed by a specific Brazilian index, IGGE (*indice de gravidade global expedito*)).[47] The period of surveys roughly corresponded to achieving the maturity level for the first bunch of CREMA (that is, most parts of the rehabilitation works had been executed by then). Table 1.1 below provides DNIT thresholds to characterize the road conditions for both indexes.

Table 1.1. – IRI and IGGE norms

IGGE	Condition	IRI
0<IGGE<20	Excellent	0<IRI<2.5
20<IGGE<40	Good	2.5<IRI<3
40<IGGE<60	Regular	3<IRI<4
60<IGGE<90	Bad	4<IRI<5.5
IGGE>90	Very bad	IRI>5.5

Source DNIT

2. For the purpose of the comparative evaluation, a database was created from DNIT pavement management system (PMS) with a focus on creating homogenous sections accordingly to the following parameters: (i) the nature of the contract (CREMA, PIR IV, Creminha, traditional rehabilitation), (ii) its status (in execution, terminated, blocked and so on), (iii) the date in years of contracts' start and end, and (iv) their condition as measured by the two indexes IRI and IGGE. Graphs derived from this database are provided in the following two pages.

3. Homogenous sections under CREMA and traditional rehabilitation contracts with a similar maturity (works *a priori* mainly executed by the time of the surveys) were identified. Weighted average (on length) and standard deviation were calculated for these sections. Final results are provided in Table 1.2.

Table 1.2. – CREMA vs. traditional rehabilitation comparing IRI and IGGE

	CREMA		Rehabilitation	
Total Extension (km)	4,111		4,251	
	IRI	IGG	IRI	IGG
Weighted average	3.03	25.02	3.09	49.19
Standard deviation	0.80	14.85	1.28	44.43

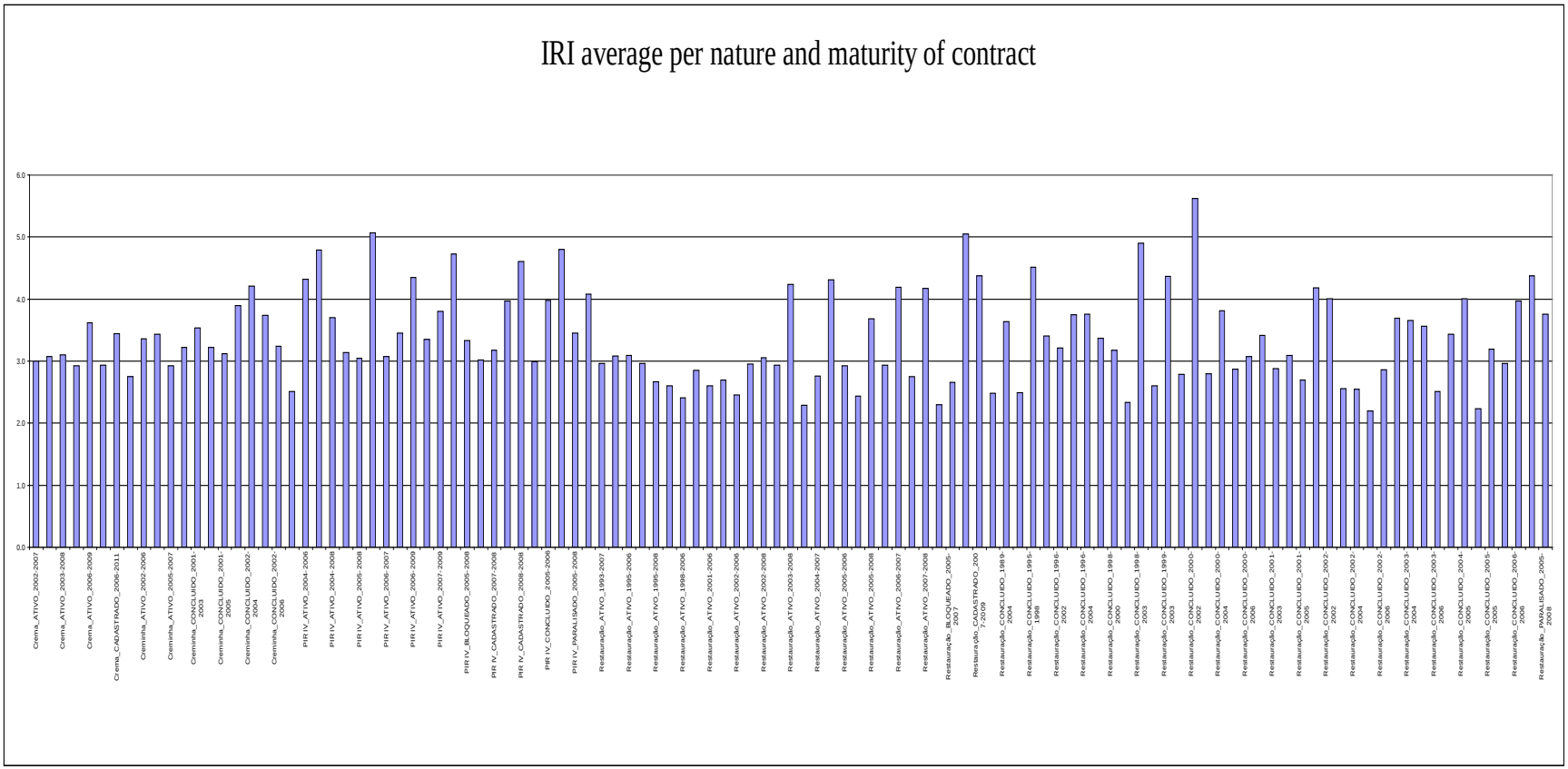
Source DNIT

4. This evaluation shows that on more than 8,000 km (11 percent) of the federal network covered by either a CREMA or a traditional rehabilitation with works executed in the years 2001 to 2005: (i) CREMA presented more even conditions than contemporaneous traditional rehabilitations, and (ii) from an IRI standpoint, conditions are similar between contract types (roads are generally in good to fair condition), but when measured by the IGGE, CREMA presented better conditions than the traditional rehabilitation. Considering the composite nature of the IGGE, this result is a probable effect of an improved maintenance in the case of CREMA. Additionally, it would tend to show an increased durability of rehabilitation works in the case of CREMA (visual defects not affecting roughness should naturally result in more severe visual conditions and potential structural alterations in the short run if no maintenance is executed).

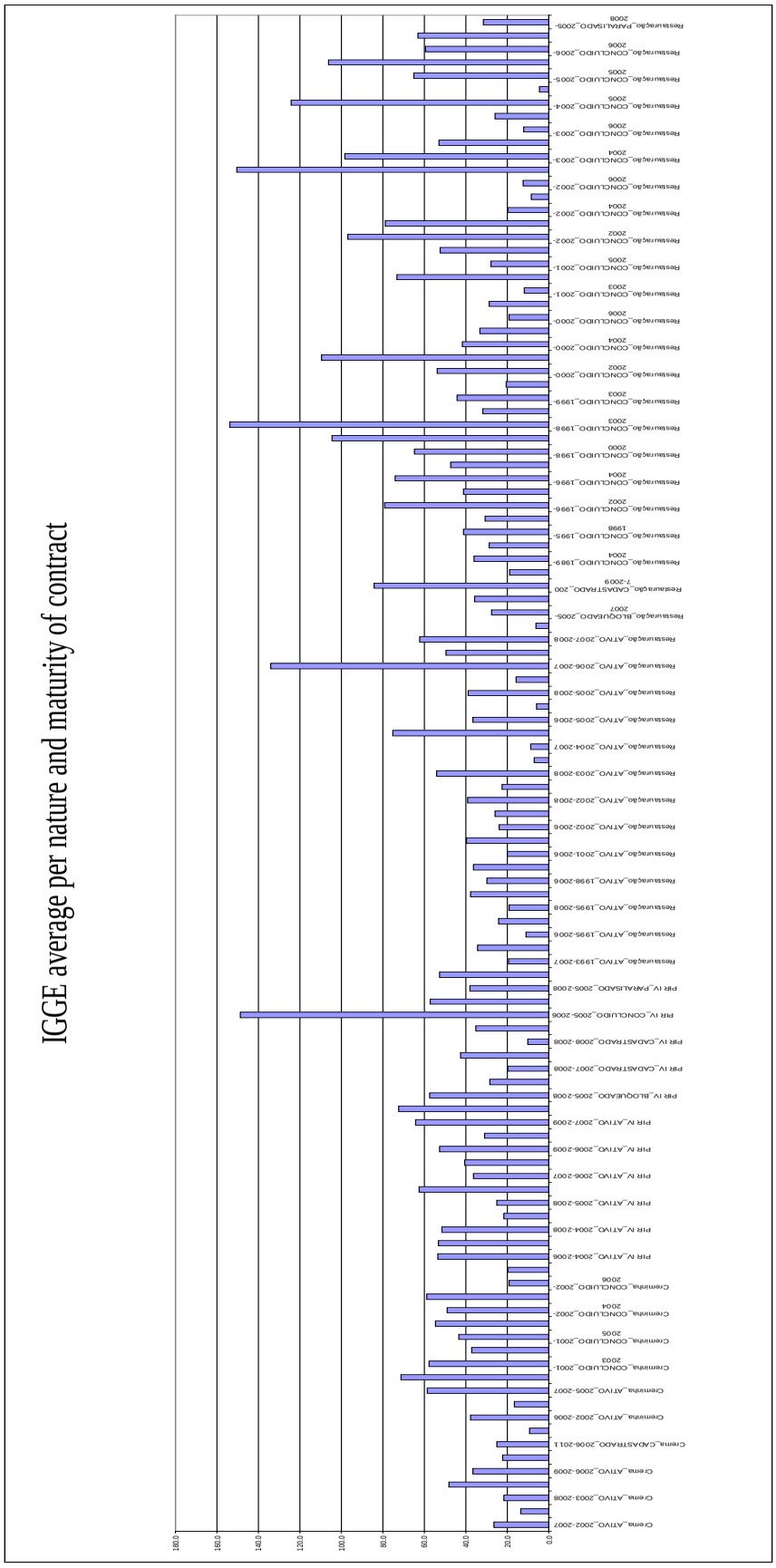
[47] The IGGE is a composite index based on the evaluation of parameters including the following defects (and their gravity): cracks, edge break, bleeding, wearing, rutting, settlement, slippery, potholes and repairs.

5. Though the situation is more diverse when it comes to CREMA *1a etapa*, the weighted average conditions measured in IRI and IGGE reached respectively 3.87 and 27, reflecting the overall regular conditions of the roads which were managed by this contract modality.

Graph 1.1. – Federal network IRI per nature and maturity of contract



Graph 1.2. – Federal network IGGE per nature and maturity of contract



ANNEX 2: CREMA AND CONVENTIONAL APPROACH COMPARATIVE EVALUATION – CONTRACT LEVEL

1. An evaluation comparing CREMA and conventional road rehabilitation and maintenance contracts at contract level has been undertaken as part of the a-posteriori evaluation of the CREMA program at the federal level. The evaluation exercise involved technical discussions and data collection of a large range of contracts. Inserted in a specifically created database, the information collected covered the contracts' main features, both from a technical and managerial standpoint, during the contracts' full cycle (bidding, execution and termination stages). The present note describes the methodologies employed and main results obtained in the evaluation.

1. Contract management analysis

CREMA

2. DNER/DNIT CREMA program comprised 18 CREMA between 2001 and 2008. 15 of these contracts, which have proceeded normally,[48] were appraised for the purpose of the evaluation (see lots in the Table 2.1). The main financial characteristics of the 15 contracts adjusted to June 2008 are summarized in Table 2.1.

Table 2.1. – CREMA management main characteristics

CREMA contracts										
CREMA Lots					Comparison of Total Values (June 2008)			Final Measured Contractual Values (June/2008) (*)		
Fund. Source	Lot	Road BR-	Extension (km)	Period (yrs)	Budget R$/km	Original Contract Value R$/km	Final Contract Value (*) R$/km	Rehab. R$/km	Improv. R$/km	Maint. R$/km/yr
IBRD	MA-03	135/MA	206.7	2002/2006	320,497	265,294	330,110	263,834	2,573	12,741
	MG-01	040/MG	424	2002/2007	303,997	261,393	319,289	242,728	2,614	12,324
	MA-04	316/MA	300.6	2002/2006	257,326	262,327	289,067	224,088	2,246	11,763
	GO-03	153/GO	212.4	2002/2006	220,227	264,559	264,559	198,686	12,962	10,582
	TO-02	153/TO	395.4	2004/2008	178,219	187,816	234,543	180,989	1,797	9,134
	PI-01	316/PI	214.4	2004/2008	213,963	186,242	184,253	133,764	4,413	9,215
	PI-02	316/PI	205.6	2004/2008	197,439	182,475	182,475	143,532	2,407	7,307
	TO-01	226/153/TO	398.2	2004/2008	156,004	168,801	168,801	120,964	7,337	8,100
	PA-01	010/316/PA	566.4	2004/2008	178,958	158,968	158,551	124,907	1,787	6,371
IDB	RS-02	285/RS	178.9	2003/2007	511,660	344,785	344,785	266,467	26,600	10,344
	RS-01	290/RS	312.7	2003/2007	312,012	197,615	241,403	210,941	8,663	3,904
	PE-01	232/PE	262.5	2003/2007	374,155	242,238	222,001	189,477	8,356	4,834
	PE-02	428/PE	571.7	2003/2007	221,428	133,628	153,658	135,013	5,613	2,443
OGU	MA-02	316/MA	320.2	2006/2010	516,343	333,198	333,198	285,832	5,603	8,353
	MA-01	010/MA	251.1	2006/2010	224,313	156,343	156,343	112,853	9,566	10,438
		Total	**4820.8**	**Averages**	**279,103**	**223,045**	**238,869**	**188,938**	**6,836**	**8,524**

Sources DNIT and the World bank

3. The above evaluation showed:

- an important price variation at all contract stages (estimates, contracted and final prices) and in contracts' components (rehabilitation, improvements and maintenance), explained by the variability in road conditions and typology of solution employed;
- discounts of between 15 and 33 percent (averaging 21 percent) provided by contractors at the bidding stage;
- contractual increments in 6 contracts (35 percent of cases), with 7.1 percent average increased value for the program as a whole (sum of final contracts value vs. sum of original contract value);
- The final contract value fell short of the budgeted costs by between 2 and 33 percent, averaging 14 percent overall.

Conventional rehabilitation contracts

4. 74 conventional rehabilitations (following a traditional approach as opposed to CREMA) executed between 1998 and 2008 were identified at the Federal Road Rehabilitation and Decentralization Program, including 69 financed by international financial institutions

[48] Two CREMA have been abandoned (GO-01 and GO-02) and a third one was changed to another form of contract.

(IFI) (31 funded by IBRD and 38 by IDB) and 5 by federal government resources. This list excluded contracts having a large proportion of heavy works, such as double lane construction, major bridges construction and/or restructuring, substantial paving, and so on.

5. A similar evaluation to the CREMA was undertaken for these contracts. A summary of the results is given in Table 2.2.

Table 2.2. – traditional contracts management general characteristics

	Extension		Budget	Original Contract Value	Final Contract Value (*)
	(km)		R$/km	R$/km	R$/km
69 contracts	4789	Average	279,245	273,885	320,118
74 contracts	5012		N.A.*	300,156	351,219

* No estimate available in DNIT

Sources DNIT and the World bank

6. The same price variation at all contract stages (estimates, contracted and final prices) as for CREMA was observed in these contracts, with a standard deviation of 25 to 40 percent from the mean. Likewise, site condition variability may explain the price discrepancy. In addition, contract prices were found to be substantially higher on average when financed by budgetary resources than by the IFI's.

7. Table 2.3 illustrates the evolution of prices at different stages of the contracts (estimate, contracted and final value) disaggregated by time.

Table 2.3. – traditional contracts general characteristics over time

Traditional rehabilitation	Budget Estimate	Contracted value	Contract final value	CREMA	Budget Estimate	Contracted value	Contract final value
	Contract vs. Estimate	Final value vs. Contract	Final value vs. Estimate		Contract vs. Estimate	Final value vs. Contract	Final value vs. Estimate
1998-2008	279,245	273,885	320,118		279,103	223,045	238,869
	-1.92%	16.88%	14.64%				
2000-2005	290,997	250,627	293,261				
	-13.87%	17.01%	0.78%		-20.08%	7.09%	-14.42%
2001-2003	284,240	237,424	276,699				
	-16.47%	16.54%	-2.65%				

Prices in the table are expressed in R$

Sources DNIT and the World bank

8. Overall the results of the above evaluations showed:

- CREMA and conventional contracts displayed similar cost discount levels at *bidding stage* (14 to 16.5 percent) when considering contemporaneous periods (2000-2005 or 2001-2003). For longer periods (10 years), the average discount drops to less than 2 percent. Tough market conditions in 2000-2005 can explain the levels of discounts (column 1 of Table 3);
- regardless of time period, addendums in the conventional rehabilitation contracts increased the *contract value* above the original contract costs by approximately 17 percent, more than double the average 7.1 percent increase in the case of CREMA;
- due to these addendums in the conventional rehabilitation contracts, *final contract values* had increased such that they generally equaled the initial estimates (before discount) for contemporaneous periods (or even exceeded them in the long run), whereas in comparison, *final values* of CREMA contracts averaged 14.5 percent lower than the initial estimate (before discount);
- Although the above averages may have hidden various realities, rehabilitation costs of CREMA represented only 54 to 59 percent of conventional rehabilitation costs (see details for rehabilitation costs for CREMA in Table 1). This is in line with the relative lighter technical solutions employed in CREMA versus the conventional approach (see paragraph 2 below on the evaluation of the employed technical solutions). This may be explained by

the fixed nature of the CREMA contracts and increased rigidity in the program management.

Road maintenance

9. Maintenance has been ensured in a relatively regular fashion in the CREMA on 4821 km during the 5 year contract duration. In comparison, the average delay for maintenance services to start following the end of rehabilitation on the sample of 74 conventionally rehabilitated road sections has been 4.3 years. Yet, this average delay is expected to increase in the future as long as road sections remain unserved by a maintenance contract: by the end of 2008, 1/3 of these road sections covering 5012 km still have not received any maintenance since the end of the rehabilitation contract. Only 15 of the above road sections have received maintenance services within one year of the rehabilitation completion.

Rehabilitation and maintenance cycle

10. So as to compare more objectively CREMA and the traditional approach for a full rehabilitation and maintenance cycle, a refined analysis was undertaken limiting the comparison to conventional contracts having: (a) rehabilitation works more strictly contemporaneous with works executed under CREMA, in the period 2001-2005, and (b) traditional maintenance services following the rehabilitation. Only 13 contracts complied with these two conditions. Detailed evaluation is provided in Table 2.4.

Table 2.4. – Sample of traditional rehabilitation main management characteristics

CONTRACTS - CONVENTIONAL REHABILITATION								MAINTENANCE			
Rehabilitation Lots					Comparison (June/2008)						
Source	Road BR-	Segment	Extension (km)	Period (yrs)	Budget R$/km	Original Contract Value R$/km	Final Contract Value (*) R$/km	Segment	Extension (km)	Period (yrs)	Final Contract Value R$ / km / yr
IBRD	452/GO	Km 133,2 to 196,9	63.7	2001/2002	262,328	237,013	272,260	Km 83,4 to 196,9	113.5	2008/2009	10,315
	070/MT	Km 524,7 to 731,9	207.2	2001/2003	243,570	219,350	256,482	Km 528,1 to 733	204.9	2007/2008	3,951
	262/MS	Km 0, to 70,0	70	2002/2004	245,004	200,512	249,792	Km 0 to 175	175	2005/2007	7,193
	262/MS	Km 70,0 to 137,9	67.9	2002/2004	206,177	184,723	229,796	Km 0 to 175	175	2005/2007	7,193
	452/GO	Km 81,0 to 133,2	52.2	2001/2002	184,864	200,403	213,823	Km 83,4 to 196,9	113.5	2008/2009	10,315
IDB	364/GO	Km 324,9 to 387,0	62.1	2002/2004	600,930	459,879	574,742	Km 324,9 to 387,0	62.1	2004/2006	18,461
	262/MS	Km 348,0 to 416,0	68	2001/2003	244,440	290,921	328,321	Km 341,8 to 465,8	124	2007/2009	24,364
	226/RN	Km 84,5 to 126,0	41.5	2001/2003	186,642	196,998	222,406	Km 84,1 to 178,2	94.1	2007/2008	8,431
	153/MG	Km 107,9 to 172,5	64.6	2001/2003	285,358	220,914	220,914	Km 0 to 129,7	129.7	2007/2009	10,464
	407/PI	Km 505,8 to 552,0	46.2	2001/2002	228,124	215,909	215,909	Km 371,2 to 559,1	187.9	2007/2008	23,433
	226/RN	Km 33,3 to 84,5	51.2	2001/2003	188,651	173,320	213,950	Km 0 to 84,1	84.1	2007/2008	11,247
	407/PI	Km 364,9 to 455,6	90.7	2001/2003	142,728	155,213	173,036	Km 371,2 to 559,1	187.9	2007/2008	23,433
	153/MG	Km 57,8 to 107,9	50.1	2001/2002	226,305	164,425	164,425	Km 129,8 to 246,5	116.8	2007/2009	9,861
		Total	**935.4**	**Averages**	**249,625**	**224,583**	**256,604**	**Total**	**1768.5**	**Averages**	**12,974**

Sources DNIT and the World Bank

11. Roughly the same tendencies as previously observed are repeated for the sample of road sections: (a) budget estimates were higher for CREMA by 12 percent (CREMA includes maintenance costs), (b) CREMA contracted prices were similar to the sample, and (c) final prices were lower for CREMA by 7 percent than the sample conventional rehabilitation. When comparing rehabilitation works only, final costs in CREMA were 26 percent lower than in the traditional approach. Unit maintenance costs were also cheaper by 34 percent in the CREMA. Other observations based on the sample include: (a) conventional rehabilitation contracts were on average 72 km long, compared to 320 km for CREMA, (b) conventional maintenance contracts following the conventional rehabilitation contracts covered on average 136 km in road length, approximately 50 percent longer than the extension covered by the rehabilitation contracts.

13. A comparison was made based on a full rehabilitation and maintenance cycle (5 years) between the 13 CREMA financed by the IFI's which works were well advanced by the end of 2006 and the above 13 identified cases (Table 2.5). Several comments are worth to be highlighted regarding the comparative quality of the maintenance services: (a) the conventional rehabilitation contracts covered only 53 percent of what would be later covered by the conventional maintenance contracts totaling 1768 km. Since during rehabilitation works contractors were tacitly in charge of the maintenance, only half of this sub-network received maintenance services during the first 3 years of the cycle; (b) maintenance services in the majority of the 13 conventional rehabilitated cases started on average 2.7 years after the end of the rehabilitation, leaving the roads without any maintenance during the same

period; (c) CREMA, on the contrary, has permitted continuity between the rehabilitation works and the maintenance services.

Table 2.5. – Full rehabilitation and maintenance cycle comparison

		Final Contract Values (R$ / km - June 2008 Values)						US$ / km
Yrs		**1**	**2**	**3**	**4**	**5**	**Total**	**Total**
CREMA								
Type of Contract		**CREMA - 5 yrs**						
Rehabilitation	Minimum	120,964					120,964	58,882
	Average	187,338					187,338	91,191
	Maximum	285,832					285,832	139,135
Maintenance	Minimum	2,443	2,443	2,443	2,443	2,443	12,217	5,947
	Average	8,389	8,389	8,389	8,389	8,389	41,947	20,419
	Maximum	12,741	12,741	12,741	12,741	12,741	63,704	31,009
								0
5 years Cycle	Minimum	133,181					**133,181**	**64,829**
	Average	229,285					**229,285**	**111,609**
	Maximum	349,536					**349,536**	**170,144**
Conventional rehabilitation and maintenance								
Type of Contract		**Rehabilitation**			**Maintenance**			
Rehabilitation	Minimum	164,425					164,425	80,037
	Average	256,604					256,604	124,907
	Maximum	574,742					574,742	279,768
Maintenance	Minimum				3,951	3,951	7,902	3,846
	Average				12,974	12,974	25,948	12,631
	Maximum				24,364	24,364	48,729	23,720
5 years Cycle	Minimum	164,425			3,951	3,951	**172,327**	**83,884**
	Average	256,604			12,974	12,974	**282,552**	**137,538**
	Maximum	574,742			24,364	24,364	**623,471**	**303,488**

Sources DNIT and the World Bank

14. Although benefiting from more regular maintenance, CREMA costs have been on average 19 percent lower than in the traditional approach considering a full cycle of rehabilitation and maintenance.

2. Technical evaluation of rehabilitation solutions

Typology of solutions

15. So as to better understand the observed differences in the costs of rehabilitation works, an evaluation of the respective typology of solutions employed both in the CREMA and sample traditional rehabilitations has been undertaken (26 contracts in total). This comparative evaluation, detailed in Table 2.6, has shown that overall lighter work solutions have been used in the case of CREMA, in line with the usage of a 5-year useful life criterion in the definition of the CREMA approach, while a 10-year useful life criterion has usually been the standard in traditional rehabilitation. In addition, when contract renegotiations occurred, CREMA cases tended to push for lighter solutions (due to the global prices nature of the contract) against heavier solutions in the traditional rehabilitation (to increase contract value).

16. The evaluation showed in particular that in CREMA, (a) functional solutions tended to predominate, while structural interventions were more common in the conventional rehabilitation, and (b) road-works generally involved short sections and a wide variety of solutions in an effort to reduce contractor costs, while the conventional rehabilitation approach involved longer segments and a limited range of solutions. In terms of technical solutions, the works in CREMA notably involved relatively thin hot mix bituminous concrete (frequently between 3 and 4 cm), while in the conventional rehabilitation, the thicknesses tended to be more substantial (between 3 and 6 cm) and some road sections benefited from cost-saving solutions made of asphalt slurry seal and reshaping while these solutions were rare in the conventional rehabilitation.

Table 2.6.– Typology of solutions

CREMA Contracts	Conventional Rehabilitation
Discontinued Interventions	**Discontinued Interventions**
Surface Repairs Deep repairs Crack Sealing Partial milling and Hot Mix Bituminous Concrete Reposition	Surface Repairs Deep repairs Partial milling and Hot Mix Bituminous Concrete Reposition
Continued Road Interventions **-Functional Interventions**	**Continued Road Interventions** **-Functional Interventions**
Coarse Slurry Seal SST-Simple Surface Treatment with Polymer DST-Double Surface Treatment with Polymer Reshaping with Hot Mix Bituminous Concrete 2cm fine mass type Resurfacing H3 with Hot Mix Bituminous Concrete 3 cm	Micro cold mix asphalt layer Reshaping with Hot Mix Bituminous Concrete 2cm thin layer type Resurfacing H3 with Hot Mix Bituminous Concrete 3 cm
-Structural Interventions	**-Structural Interventions**
F3H3 and F4H4 milling, with 3 our 4cm, with Hot Mix Bituminous Concrete reposition Reforming, DST and reinforcement with Hot Mix Bituminous Concrete (3,4, 5 or 6cm) DST and reinforcement in Hot Mix Bituminous Concrete (3,4,5 or 6 cm) Reshaping with Hot Mix Bituminous Concrete of 2cm fine mass type and reinforcement in Hot Mix Bituminous Concrete (3 or 4 cm) Millingm reshaping with Hot Mix Bituminous Concrete for a type of 2cm fine mass type, and reinforcement with Hot Mix Bituminous Concrete (3cm) Reconstruction with base re-stabilization and DST Reconstruction: recycling (with crushed stone or cement), and DST with polymer Reconstruction: recycling (with crushed stone or cement) and Hot Mix Bituminous Concrete (4 or 5 cm)	Milling, with 4 or 5cm, with Hot Mix Bituminous Concrete reposition Milling and reinforcement with Hot Mix Bituminous Concrete (3,4,5 or 6cm) Reshaping with Hot Mix Bituminous Concrete of 2cm fine mass type and reinforcement in Hot Mix Bituminous Concrete (3,4, 5 or 6 cm) Asphalt micro layer and reinforcement with Hot Mix Bituminous Concrete (3,4,5 or 6cm) Milling, reshaping with Hot Mix Bituminous Concrete for a type of 2cm fine mass type, and reinforcement with Hot Mix Bituminous Concrete (3,4,5 or 6 cm) Reconstruction: recycling (with crushed stone or cement), and Hot Mix Bituminous Concrete (4 or 5 cm) Reconstruction with re-stabilization of the base and TSD Reconstruction: re-stabilization of base, new base and Hot Mix Bituminous Concrete (4 to 8cm) Total Reconstruction: Removal, sub base, new base, and Hot Mix Bituminous Concrete (5 to 8cm)

Sources DNIT and the World Bank

17. Two *indices of solutions* were designed to try to objectively characterize the above perceived use of lighter technical solutions in the case of CREMA, using weighed sums (based on the length) of the respective strength of the solutions used on each road work. The respective strength of each solution was evaluated: (a) for the first index, IS_{cst} as the quotient of DNIT price per square meter of the solution in relation to a typical "average" solution (a 3cm AC strengthening); (b) for the second index, IS_{SN} as a quotient of the structural number (SN)[49] of the solution in relation to the SN of the same typical average solution. Results of the evaluation, provided in Table 2.7, confirmed that CREMA were characterized by lighter solutions than the traditional rehabilitation.

Table 2.7. – Indicators of solutions

CREMA				Traditional rehabilitation			
Lot	**Extension (km)**	**IS cst**	**IS SN**	**Lot**	**Extension (km)**	**IS cst**	**IS SN**
MA-04	300.6	1.57	1.71	452/GO	52.2	2.48	6.68
PI-02	205.6	1.5	4.05	452/GO	63.7	2.46	6.28
MA-03	206.7	1.48	1.98	262/MS	70	2.41	6.07
TO-02	395.4	1.47	1.85	262/MS	67.9	1.98	4.24
GO-03	212.4	1.43	1.43	070/MT	207.2	0.81	1.04
MG-01	424	1.24	2.08	364/GO	62.1	3.1	9.14
TO-01	398.2	1.24	1.88	407/PI	46.2	2.9	9.79
PI-01	214.4	0.87	0.66	407/PI	90.7	2.51	6.19
PA-01	566.4	0.62	0.96	226/RN	41.5	1.81	1.59
RS-02	178.9	1.95	1.68	153/MG	64.6	1.78	1.67
PE-01	262.5	1.94	3.17	226/RN	51.2	1.75	1.51
RS-01	312.7	1.49	1.99	262/MS	68	1.71	3.31
PE-02	571.7	0.93	0.98	153/MG	50.1	1.5	1.96
	Extension	**IS cst**	**IS SN**		**Extension**	**IS cst**	**IS SN**
	4249.5	**1.27**	**1.75**		**935.4**	**1.91**	**4.10**

Sources: DNIT and the World Bank

Dispersion and variability of employed solutions

18. In order to also objectively characterize the perceived larger variety of solutions in the case of CREMA, two supplementary indicators were designed: (a) a dispersion index, *DI*, defined as the range of variation of the IS_{cst} in each lot (difference between the largest and smallest IS), and; (b) a variability index, *VI*, as the average length of each solution employed continuously. Results of the evaluation, provided in Table 2.8, also confirmed that CREMA were characterized by a larger dispersion and solutions were applied on shorter extensions.

[49] AASHTO index defining the structural capacity or strength of a solution

Table 2.8. – Indicators of variability and dispersion

CREMA							Traditional rehabilitation						
Lot	Length (km)	Lower IS	Higher IS	Dispersion index	Homogeneous segment	Variability index	Lot	Length (km)	Lower IS	Higher IS	Dispersion index	Homogeneous segment	Variability index
MA-04	300.6	1.0	1.8	0.8	33	9	452/GO	52.2	2.4	2.6	0.2	6	9
PI-02	205.6	0.4	2.6	2.2	43	5	452/GO	63.7	2.4	2.6	0.2	5	13
MA-03	206.7	0.8	3.4	2.6	17	12	262/MS	70.0	0.4	3.9	3.5	12	6
TO-02	395.4	0.4	3.4	3.0	98	4	262/MS	67.9	1.0	3.4	2.4	6	11
GO-03	212.4	0.4	3.4	3.0	40	5	070/MT	207.2	0.7	1.3	0.6	11	19
MG-01	424.0	0.4	2.4	2.0	89	5	364/GO	62.1	2.6	3.9	1.3	4	16
TO-01	398.2	0.4	3.8	3.4	258	2	407/PI	46.2	2.4	3.9	1.5	4	12
PI-01	214.4	0.4	2.0	1.6	28	8	407/PI	90.7	2.4	3.9	1.5	6	15
PA-01	566.4	0.4	3.4	3.0	112	5	226/RN	41.5	1.0	2.1	1.1	5	8
RS-02	178.9	0.4	3.4	3.0	42	4	153/MG	64.6	1.0	1.8	0.8	3	22
PE-01	262.5	1.0	2.4	1.4	61	4	226/RN	51.2	1.0	2.1	1.1	4	13
RS-01	312.7	0.4	3.4	3.0	54	6	262/MS	68.0	1.6	1.9	0.3	11	6
PE-02	571.7	0.4	2.4	2.0	132	4	153/MG	50.1	1.8	1.8	0.0	4	13
	Length			DI		VI		Length			DI		VI
	4,249.5			2.42		5.24		935.4			1.09		13.53

Sources: DNIT and the World Bank

3. Road conditions at the end of the rehabilitation and maintenance cycle

19. The above evaluations showed that CREMA have been more economic than traditional rehabilitation, notably thanks to better customization of rehabilitation solutions and cheaper maintenance. To fully evaluate the performance of CREMA as compared to the traditional approach, road conditions were evaluated for the road sections covered by each one of the abovementioned 26 contracts (CREMA & conventional rehabilitation samples). By chance, surveys of the road conditions of the federal network have been undertaken in early 2007 for the first time since 2001, roughly at the end of the 13 CREMA rehabilitation works. The data from the surveys populated two indicators, the roughness (IRI) and the Brazilian indicator for visual conditions IGGE.[50] Results are provided in Table 2.9 indicating that similar IRI was found under both types of contracts, yet the higher visual conditions indicator for the conventional rehabilitation symbolizes those segments as being in worse conditions.

Table 2.9. – Comparison of afterward conditions on evaluated sample

CREMA				Traditional rehabilitation			
Lot	Length (km)	IRI	IGGE	Road BR-	Length (km)	IRI	IGGE
MA-03	206.7	2.72	33	452GO	63.7	6.3	61
MG-01	424.0	3.60	35	070MT	207.2	3.2	42
MA-04	300.6	2.53	22	262MS	70.0	2.9	31
GO-03	212.4	2.56	22	262MS	67.9	3.0	54
TO-02	395.4	3.04	17	452GO	52.2	5.4	54
PI-01	214.4	3.02	19	364GO	62.1	2.1	9
PI-02	205.6	3.63	15	262MS	68.0	2.6	38
TO-01	398.2	3.18	24	226RN	41.5	2.5	8
PA-01	566.4	2.87	24	153MG	64.6	2.7	19
RS-02	178.9	2.73	43	407PI	46.2	3.5	6
RS-01	312.7	2.46	19	226RN	51.2	2.5	8
PE-01	262.5	3.59	24	407PI	90.7	3.3	4
PE-02	571.7	3.07	13	153MG	50.1	5.1	66
	Length	**IRI**	**IGGE**		**Length**	**IRI**	**IGGE**
	4,249.5	**3.02**	**22.87**		**935.4**	**3.41**	**32.22**

Sources DNIT and the World Bank

20. Unfortunately, an evaluation of the respective structural conditions of the pavements was not possible due to the absence of relevant data by early 2007 (planned bidding for deflection works have actually been stuck for the past 3 years in DNIT due to administrative problems).

21. Overall, road sections covered by CREMA, though benefiting from lighter and more economic rehabilitation solutions, and despite an overall lower cost, tend to result in slightly better conditions than in the traditional rehabilitation and maintenance approach, in relatively similar conditions of execution. Reasons to explain these results, include, most notably, the implication of more dedicated contractors committed to medium term results, and, improved maintenance management system, both on a more continuous basis and based on preventive rather than more expensive curative actions.

[50] See definition in Annex 3.

ANNEX 3: FEDERAL ROAD NETWORK GENERAL CHARACTERISTICS

1. Brazil Federal road system length is about 73,000 km, paved at 80 percent. Table 3.1 provides the details of the roads distributions per region and category, including the network transferred to the states (MP082) and the concessions.

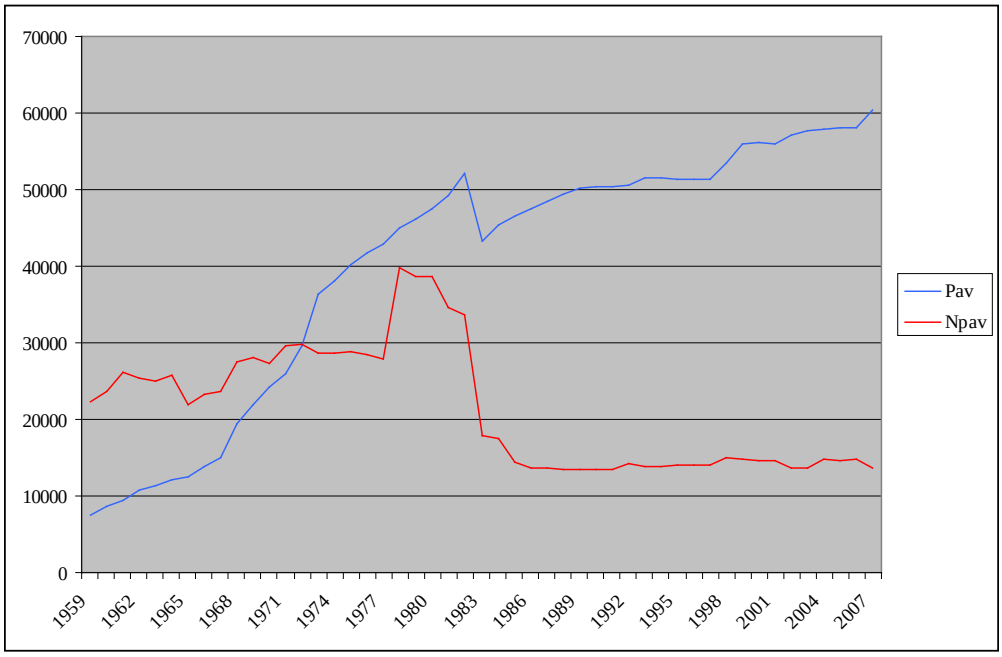
Table 3.1. – Federal network characteristics

Region	Federal network (PNV)		MP 082 2002		Concessions	Federal Network (without transfers)	
	Unpaved	Paved	Unpaved	Paved		Unpaved	Paved
Norte	8,586	6,074	750	207	0	7,836	5,867
Nordeste	2,004	18,146	596	2,423	0	1,408	15,724
Sudeste	1,561	13,719	1,141	5,152	795	420	7,771
Sul	805	10,596	381	2,552	3,638	424	4,406
Centro-Oeste	1,901	9,617	179	1,126	0	1,722	8,492
Total	**14,857**	**58,152**	**3,047**	**11,460**	**4,434**	**11,810**	**42,259**
	73,009		**14,506**		**4,434**	**54,069**	

Sources: DNIT 2008

2. Graph 3.1 below provides historic data on the federal network characteristics. Observed declines in the paved network in 1982, 1994 and 2001 are respectively due to a first transfer of federal roads to the States, a change in the nomenclature, and the result of the second transfer of roads considered of local interest to the states (see note on the MP 082).

Graph 3.1. – Federal network evolution in time



Sources: DNIT 2008

3. Two main trends can be seen from this graph: (i) ***a construction boom, from the early 1950s until the early 1980's***, both for paved and unpaved roads, and (ii) ***an improvement period***, in which activities are very much focused on paving the existing network.

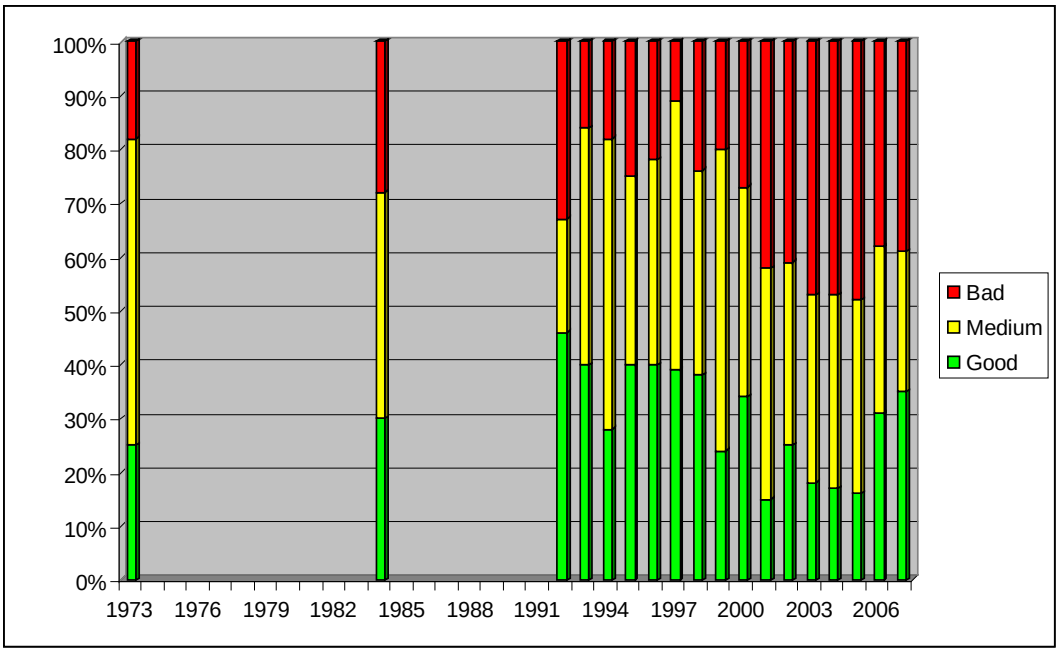
4. During the first period, approximately 2,300 km of roads were built every year. In total, more than 43,000 km (or nearly 70 percent) of roads were paved between 1965 and

1985. Since then, the paving rhythm has decreased but remains in the range of 700 to 750 km per year on average.

5. As of 2005, ***more than 2/3 of the federal roads were already between 20 to 40 years old***. Such a network, though often super-dimensioned at construction stage, has reached a point requiring heavy rehabilitation, all the more so when considering (i) the evolution of the nature of traffic and intensity over the period, notably heavy vehicles, and (ii) the aggressive weather conditions in the Brazilian climate. An important bulk of rehabilitation and strengthened maintenance has been needed since the 1980's, but road programs did not adapt fast enough. As a result, road conditions have rapidly deteriorated, notably since the mid 1990's. Meanwhile, the country has faced economic difficulties signifying insufficient funds allocated to the road sector.

6. The graph below gives the evolution of the condition of the federal network since 1973 (first year of evaluation), when data are available. It illustrates the important deterioration of the network conditions from the mid-1990's to the mid-2000s.

Graph 3.2. – Federal network condition evolution



Sources: DNIT 2008

7. As shown in Table 3.2, of 36,300 km of road, 6,500 km were in bad condition, 20,700 km in regular condition and 9,100 km in good condition in 1973. In 2005, while the paved network extension had nearly doubled (60,000 km) and approximately the same proportion of roads were in regular and good condition (20,900 and 9,300 km, respectively, equivalent to 1973 sizes), roads in bad condition nearly tripled 1973 values (27,000 km).

Table 3.2. – Federal condition network

	Good		Regular		Bad	
1973	9,076	25%	20,693	57%	6,535	18%
1984	13,588	30%	19,023	42%	12,682	28%
1995	20,548	40%	17,980	35%	12,843	25%
2005	9,304	16%	20,934	36%	27,912	48%

Sources: DNIT 2008

ANNEX 4: PAYMENT DELAYS DURING CREMA PROGRAM

1. An *a posteriori* evaluation of payments characteristics of CREMA at program level was undertaken, limited to the 17 contracts which were totally or partially financed by International Finance Institutions (IFI's) (due to data availability). Detailed results are provided in the table on the next page.

2. As shown in the table, ***payments*** of invoices have been implemented with an ***average delay of 4.62 months*** in a relatively ***irregular fashion*** (standard deviation to the mean of 2.15).

		Contract (IBRD funding)												IADB funding						
		MA03	MG01	MA04	GO01*	TO02	TO01	MA01**	Go02*	Go03	PA01	PI01	PI02	MS01	MS01	RS01	PE01	RS02	PE02	
Year	Month	165 / 01	166 / 01	167 / 01	168 / 01	169 / 01	103 / 03	114 / 03	115 / 03	116 / 03	117 / 03	118 / 03	119 / 03	178 / 03	247 / 04	049 / 02	050 / 02	051 / 02	052 / 02	GERAL
2002	janeiro	1.0	1.0	1.0	2.0	1.0														**1.20**
	fevereiro	1.4	1.4	5.0	1.6	5.0														**2.88**
	março	4.0	4.0	4.0	4.0	4.0														**4.00**
	abril	6.0	5.5	5.5	5.5	5.5														**5.62**
	maio	5.0	5.0	5.0	5.0	5.0														**5.00**
	junho	4.0	4.0	4.0	4.0	4.0														**4.00**
	julho	3.8	4.0	3.8	4.1	4.0														**3.93**
	agosto	3.2	3.8	4.0	3.0	3.0														**3.40**
	setembro	3.5	3.0	5.0	3.1	4.1														**3.73**
	outubro	4.4	38.0	7.2		6.6														**14.03**
	novembro	7.7	6.0	8.0		8.0														**7.41**
	dezembro	13.9	14.2	14.2		14.2											10.0	10.0	8.8	**12.19**
2003	janeiro	9.2	6.0	6.0		6.0										14.0				**8.24**
	fevereiro	5.0	5.0	5.0		5.0										13.0	5.0	8.0	8.0	**6.75**
	março	4.8	4.0	4.0		4.0										12.0				**5.77**
	abril	5.9		3.8												11.0				**6.89**
	maio	5.2		4.4												10.0				**6.53**
	junho	4.2	4.2	4.2		4.2										9.0	6.0	9.0	4.0	**5.60**
	julho	3.4	3.2	3.2		3.4										8.0	3.0	8.0	3.4	**4.46**
	agosto	2.4	2.4	4.0		4.0										7.0	4.0	7.0	2.6	**4.17**
	setembro	1.4	4.0	6.0		6.0										6.0	4.9	6.0	5.6	**4.98**
	outubro	5.0	5.8	5.8		5.0	5.6									5.0	5.0	5.0	5.0	**5.24**
	novembro	4.8	6.3	5.3		4.0	5.6	7.2	7.5	7.2	5.6	7.6	8.0			4.4	4.0	4.0	4.0	**5.70**
	dezembro	6.2	6.2	6.9		7.0	6.2	6.2	6.6	6.2	6.3	7.4	7.0	7.0		5.8	4.1	9.0	8.0	**6.63**
2004	janeiro	6.9	6.0	7.8		6.0	6.0	8.0	6.8	6.0	6.0	6.8	6.0	6.0		6.0	6.0	6.0	6.0	**6.39**
	fevereiro	6.6	5.0	6.8		5.9	6.5	7.0	6.8	6.8	34.6	5.9	5.0	5.0		5.0	5.0	5.0	5.0	**7.61**
	março	5.6	4.8	6.0		5.7	5.6	6.0	6.0	6.0	5.7	5.0	4.9	4.0		4.0	5.9	6.0	4.0	**5.33**
	abril	4.8	4.8	5.0		5.0	4.8	5.0	9.0	5.8	4.8	4.8	4.8			5.0	5.0	5.0	5.0	**5.24**
	maio	4.0	4.0	5.0		5.0	4.0	4.8	8.0	5.0	4.0	4.0	4.0			4.0	4.0	4.0	4.0	**4.52**
	junho	4.0	4.0	4.0		4.0	4.0	4.0	7.0	4.0	4.0	4.0	4.0			4.0	4.0	4.0	3.3	**4.15**
	julho	3.0	5.0	3.2		3.0	3.0	3.0	6.0	4.0	3.1	3.0	3.0			3.1	3.0	4.0	3.0	**3.49**
	agosto	3.0	4.0	4.0		3.1	3.0	4.0	5.0	4.0	4.0	3.0	3.0			2.7	3.0	4.0	2.0	**3.46**
	setembro	3.0	3.0	31.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0			3.0	3.0	3.4	3.0	**5.03**
	outubro	2.1	2.0	30.0		2.0	2.0	5.8		3.0	2.0	2.0	2.0			2.0	2.0	2.0	5.1	**4.57**
	novembro	1.0	1.0	29.0		9.4	7.0	6.8		5.8	9.0	5.8	5.8			1.0	1.0	1.5	10.4	**6.75**
	dezembro	6.0	4.8	28.0		10.0	6.0	6.0		4.9	9.0	5.8	5.3			5.7	6.0	6.0	9.8	**8.09**
2005	janeiro	5.0	5.0	8.0		5.0	5.2	5.0		5.0	8.2	5.0	5.0			5.9	8.0	5.2	5.2	**5.77**
	fevereiro	4.0	4.0	7.2		6.3	4.2	4.0		4.0	8.0	4.0	4.0		4.0	6.0	7.0	4.9	7.0	**5.24**
	março	6.2	3.2	7.0		5.0	4.2			4.8	7.0	5.0	5.0		4.5	6.0	7.0	5.9	6.0	**5.48**
	abril	6.0	3.9	6.0		6.0	4.0			4.6	6.0	5.0	5.0		3.6	6.0	6.0	6.0	7.0	**5.36**
	maio	5.0	4.0	5.0		5.0	3.2			2.0	5.0	4.0	4.2		3.2	6.0	5.0	5.0	7.0	**4.54**
	junho	4.0	3.8	4.0		4.0	6.0			3.6	5.0	4.0	4.0		3.1	5.0	10.0	4.0	6.0	**4.75**
	julho	3.0	2.8	5.0		4.0	4.4			3.0	4.0	3.0	3.0		3.0	4.0	14.0	3.0	5.0	**4.37**
	agosto	2.0	2.0	4.0		3.3	3.4			2.0	4.0	2.0	3.0		2.0	3.0		3.0	4.0	**2.90**
	setembro	2.0	2.0	3.0		5.0	2.4			1.2	3.0	4.0	3.0		2.0	4.0		3.0	3.0	**2.89**
	outubro	2.0	2.0	2.0		4.0	2.0			1.0	2.0	3.0	2.0		2.0	3.0		2.0	2.0	**2.23**
	novembro	1.0	1.0	1.0		3.0	2.0			2.0	2.0	2.0	4.0		2.0	5.6		2.7	1.3	**2.27**
	dezembro	2.0	4.9	2.0		3.0	2.2			2.1	5.0	3.0	3.0		3.0	5.0	14.0	3.0	4.0	**4.01**
2006	janeiro	3.0	4.0	4.1		3.0	4.0			2.0	7.0	3.0	3.0		3.0	6.0		6.0	4.0	**4.01**
	fevereiro	2.0	3.0	3.1		2.0	5.0			2.0	6.0	2.0	5.0		3.6	6.0		6.0	3.0	**3.75**
	março	5.2		2.1		3.0	4.9			3.0	6.0	2.0	4.0		3.0	6.0		6.0	4.0	**4.10**
	abril	4.0		3.1		4.0	4.2			2.0	8.0	4.0	3.0		2.0	5.0		6.0	6.0	**4.27**
	maio	3.0	4.0	3.1		3.0	4.0			2.0	7.0	4.0	4.0		3.0	4.0		5.0	5.0	**3.93**
	junho	3.0	3.0	3.0		3.0	3.0			2.0	6.0	4.0	3.1		2.0	4.0		5.0	4.0	**3.47**
	julho	2.1	2.0	3.1		4.0	2.2			2.0	5.0	3.0	5.0		2.0	5.0		5.0	5.0	**3.49**
	agosto	2.0	1.0	4.0		3.0	2.2			2.0	4.0	4.0	4.0		2.5	4.0	8.0	4.0	4.0	**3.48**
	setembro	3.0	3.0	3.0		3.0	3.0			2.0	3.0	3.0	3.0		2.0	3.0	8.0	3.0	3.0	**3.22**
	outubro	2.0	2.0	2.0		2.0	2.0			2.0	2.0	3.0	6.0		2.0	6.0	2.0	6.0	6.0	**3.22**
	novembro	1.0	2.0	3.8		1.0	2.5			2.0	5.0	6.0	5.0		2.0	5.0	2.0	5.0	5.0	**3.39**
	dezembro	6.0	2.0	3.0		1.0	3.2			3.1	8.0	4.0	4.0		2.0	4.0	2.0	6.0	4.0	**3.74**
2007	janeiro	5.0	8.0	2.0		3.0	3.0			3.0	11.0	3.0	3.0		2.0	5.0	4.0	7.0	5.0	**4.57**
	fevereiro		6.0	3.0		3.0	2.0			2.0	7.0	5.0	5.0		3.0	5.0	3.0	6.0	4.0	**4.16**
	março		5.0			2.0	2.0			2.0	6.0	5.0	4.0		2.0	5.0	2.0	6.0	4.0	**3.75**
	abril		4.0			2.0	2.0			2.0	5.0	4.0	3.0		3.0	4.0	2.0	5.0	3.0	**3.25**
	maio		3.0			3.0	2.0			2.0	5.0	4.0	4.0		3.0	5.0	6.0	5.0	3.0	**3.76**
	junho		2.0			2.0	2.0			2.0	4.0	2.0	3.0		3.0	4.0	5.0	5.0	3.0	**3.09**
	julho		2.0			8.0	2.0			2.0	4.0	2.0	2.0		2.0	6.0	4.0		3.0	**3.37**
	agosto		1.0			8.0	2.0			3.4	3.0	2.0	2.0		4.0	6.0	3.0		2.0	**3.31**
	setembro		2.0				2.0			2.0	3.0	7.0	3.0		3.0	5.0	4.0		3.0	**3.40**
	outubro		5.0				2.0			2.0	6.0	6.0	2.0		3.0	5.0	3.0		4.0	**3.80**
	novembro		4.0				2.0			1.0	5.0	5.0	4.0		4.0	5.0	2.0		4.0	**3.60**
	dezembro		3.0				4.0			3.0	4.0	4.0	4.8		5.0		6.0		3.0	**4.09**
2008	janeiro						3.0			3.0	4.0	3.0	3.0		6.0				3.9	**3.70**
	fevereiro						2.0			2.0	3.0	2.0	3.0		6.0				4.0	**3.14**
	março						2.0			5.0	4.0	3.0	3.0		5.0					**3.67**
	abril						3.0			3.0	4.0	4.0			5.0					**3.80**
	maio						2.0			3.0		3.0			4.0					**3.00**
	junho						2.0			2.0		2.0								**2.00**
Average		**4.08**	**4.34**	**6.16**	**3.58**	**4.42**	**3.45**	**5.36**	**6.87**	**3.17**	**5.66**	**3.93**	**3.94**	**5.50**	**3.11**	**5.48**	**5.02**	**5.13**	**4.57**	**4.62**
Variance		**4.80**	**20.85**	**41.95**	**1.49**	**4.97**	**2.15**	**2.13**	**1.13**	**2.42**	**19.63**	**2.15**	**1.61**	**1.25**	**1.27**	**5.86**	**8.02**	**3.16**	**3.45**	**4.64**
Std Deviation		**2.19**	**4.57**	**6.48**	**1.22**	**2.23**	**1.47**	**1.46**	**1.06**	**1.56**	**4.43**	**1.47**	**1.27**	**1.12**	**1.13**	**2.42**	**2.83**	**1.78**	**1.86**	**2.15**
Variation		**53.72%**	**105.23%**	**105.17%**	**34.05%**	**50.43%**	**42.55%**	**27.22%**	**15.47%**	**49.09%**	**78.34%**	**37.35%**	**32.25%**	**20.33%**	**36.16%**	**44.18%**	**56.40%**	**34.64%**	**40.69%**	**42.35%**

***GO01 and GO02: Contracts cancelled**

****MA01: contract cancelled, then financed under Government resources (no data available on payments characteristics)**

***** MS 01: 178/03 contract cancelled then attributed to second bidder under a new contract (247/04)**

ANNEX 5: FIRST CREMA MAINTENANCE STANDARDS AND INDICATORS

The monitoring systems were composed of 8 indicators on work management at Federal level, 3 on works quality of execution (respectively 4 in the state of Rio Grande do Sul), including IRI, rutting, deflection, deformation and level high between lanes and with shoulders, and 88 maintenance indicators (20 in the state of Rio Grande do Sul).

1. Table 5.1 – Services, activities and groups of activities (extract)

TABLE 5.1 - CREMA - TECHNICAL NOTES BY SERVICE, ACTIVITY AND GROUPS OF ACTIVITIES FOR INITIAL REPAIRS.

GROUPS AND ACTIVITIES		SERVICES - Codes					ACCEPTANCE CRITERION	MEASUREMENT CRITERION	PAYMENT CRITERION
ITEM	DESCRIPTION	CODE	DESCRIPTION	UNIT	DESCRIPTION	SPECIFICATION			
1	- Initial Repairs					Item 4 - Section 5 Standards (PD) of Item 8 - Section 5 Chapter 2 of the CREMA SO			
1.1	***Recovery of the Maintenance Backlog - Operational Safety Items***	RI1	- Preparation of Initial Repair Design - Routine maintenance services. - Priority services for traffic safety - Start at beginning of Contract and Completion by End of 6th month	monthly	a. Rolling Surface . Correction of potholes, deformations and other defects . Removal of obstacles and materials which are safety hazards b. Signaling and marking . Reinstatement of horizontal marking on sections where no rehabilitation works are envisaged . Reinstatement of temporary horizontal marking on sections where rehabilitation works are envisaged . Installation of kilometer marks . Replacement and cleaning of sign boards . Complementing vertical regulatory, warning and indicative signs . Implementation of DNER User Communication System signs c. Shoulders . Removal of obstacles and hazardous materials d. Drainage . Correction of areas with water accumulating or crossing . Cleaning/Reinstatement of surface drainage & routine structures . Cleaning/Reinstatement of underground drainage . Complementing surface drainage and routine structures . Complementing sub-horizontal drains d. Complementary Works . Installation/Reinstatement of Safety Devices e. Right-of-way Strip . Environmental Rehabilitation of risk situations . Cleaning, Pruning and Weeding . Removal of large sized debris . Removal of vegetation hampering visibility	PD1, PD2 and DNER-ES 321/97 PD3 PD12, DNER-ES 339/97 and IPR 705/100* PD12, DNER-ES 340/97 and IPR 705/100* PD12 and IPR 75/100* PD12, DNER-ES 340/97 and IPR 75/100* PD9 DNER-ES 297/97 PD16 PD16 and DNER-ES 298/97 PD16 PD16 and DNER-ES 293/97 to DNER-ES 291/97 ; DNER-ES 294 and 295/97 PD16 PD18 PD22 and DNER-ES 321/97 PD21 PD3/20 PD21	Acceptance of services will be monthly, conditioned to checking conformity with DNER specifications and performance standards. Verification will be through the data provided in the Monthly Activity Report Acceptance of the services will be conditional on submission and approval of the Monthly Activities Report In the case of the months that correspond to the conclusion of stages (6th & 12th), acceptance will be conditional on verifying compliance with the performance standards and specifications.	Monthly measurement according to percentages of current activity schedule, conditional on acceptance of services.	Monthly payment based on % of Total Lump Sum Price stated in the current Activity Schedule after measurement of services
1.2	***Recovery of the Maintenance Backlog - Functional Integrity of the Highway Facilities***	RI2	- Routine maintenance services. - Services to rehabilitate minimum functional conditions. - Maximum Completion Period: End of 12th month	monthly	a. Signaling and marking . Complementing informative routing signs b. Shoulders . Correction of potholes, deformations and other defects . Correction of drop between pavement and shoulder levels c. Drainage . Cleaning and replacement of deep drains . Complementing deep drain system	PD12, DNER-ES 340/97 and IPR 75/100* PD10 and DNER-ES 321/97 PD11 DNER-ES 297/97 PD17 and DNER-ES 292/97 PD17 and DNER-ES 292/97			

2. Table 5.2. – Performance standard (extract)

Table 8.1 – Performance Standards for Lanes (Part 1)

Reference Element	Indicators	Standard Required	Code	Period for correction
Lane	Potholes	No potholes of any size are allowed on the lanes after the end of the 6th month of the contract.	**PD1**	- 24 hours
	Plastic deformations in the surfacing, Depressions and Settlement	No deformations are allowed causing a level difference of more than 1.5 cm between two adjacent points measured on the lane surfacing after the end of the 6th month.	**PD2**	- 24 hours for depressions next to routine structures. - 1 week for other deformations.
	Obstacles or dangerous materials	After the end of the 6th month, no obstacles or material deposits are allowed on the lanes that constitute a risk to operational safety.	**PD3**	- 24 hours.
	Longitudinal irregularities for Lots **TO-01, PA-01, MA-01, MA-02 and PI-01**	- For paved sections, irrespective of the type of surfacing: - IRI ≤ 4.5 mm/m over 100% of the length of the Lot, as from the end of the 1st year of the contract. - For sections paved with Asphalt Concrete: - IRI ≤ 3.5 mm/m over at least 75% of the length of the Lot, as from the end of the 2nd year of the contract. - IRI ≤ 3.5 mm/m over at least 85% of the length of the Lot, as from the end of the 3rd year of the contract. - IRI ≤ 3.5 mm/m over at least 95% of the length of the Lot, as from the end of the 4th year of the contract	**PD23**	- 1 month
	Longitudinal irregularities for Lot **PI-02**	- For paved sections, irrespective of the type of surfacing: - IRI ≤ 4.5 mm/m over 100% of the length of the lot, as from the end of the 3rd year of the contract. - For sections paved with Asphalt Concrete: - IRI ≤ 3.5 mm/m over at least 70% of the length of the Lot, as from the end of the 2nd year of the contract. - IRI ≤ 3.5 mm/m over at least 85% of the length of the Lot, as from the end of the 3rd year of the contract. - IRI ≤ 3.5 mm/m over at least 95% of the length of the Lot, as from the end of the 4th year of the contract	**PD24**	- 1 month

3. Table 5.3. – Liquidated damages/fines (extract)

Table 4.3: Liquidated Damages referring to Routine Highway Maintenance - Permanent Supervision (*)

Type of Physical Structure	*Nature of the Problem or Defect to be Inspected and the Procedure to be Adopted*					
	Roadway Facility	Nature of the Problem or Defect	CREMA Standing Orders	Parameters to be Verified (2) or Performance Standards (PD)	Fine (3) Reference (3)	Value(R$)
Pavement of the main highway, frontage roads, intersections, access roads, inter-changes & returns	Pavement of road	Depressions and potholes	AP1	PD1 - TER 01/78, DNIT-ES-Continuous Visual Survey	Daily/hole	70.00
		Depressions adjacent to structures	AP2	PD2 - TER 01/78, DNIT-ES-Continuous Visual Survey	Daily/defect	350.00
		Depressions and subsidence	AP3	PD2 - TER 01/78, DNIT-ES-Continuous Visual Survey	Daily/defect	25.00
	Rigid pavement of road	Potholes and depressions	AP1	PD1 - TER 01/78, DNIT-ES-Continuous Visual Survey	Daily/hole	70.00
		Broken slabs and edges (2)	AP11	PD2 - TER 01/78, DNIT-ES-Continuous Visual Survey	Daily/slab	160.00
		Depressions and subsidence	AP3	PD2 - TER 01/78, DNIT-ES-Continuous Visual Survey	Daily/defect	25.00
		Cracking and exposed joints(2)	AP10	PD7 - Visual Evaluation of the Event	Daily/m	10.00
Median and Right of Way	Median barrier, platform, areas adjacent to the highway and frontage roads, intersections, access roads, interchanges and returns	Deposits of litter, rubble and rests of pruning on the road platform	AP29	PD20 - Visual Evaluation of the Event	Daily/km	10.00
		Lack of cleaning and sweeping of roadway platform	AP28	PD20 - Visual Evaluation of the Event	Daily/km	10.00
		Trees which endanger traffic	AP26	Visual Evaluation of the Event	Daily/Event	10.00
		Dead animals	AP30	PD20 - Visual Evaluation of the Event	Daily/Event	50.00
		Lack of pruning and clipping of vegetation in the median and verges, shoulders	AP20	PD21 - and CREMA Standing Orders	Daily/km or fraction thereof	10.00
		Lack of weeding of vegetation in the median, verges and shoulders	AP22	PD21 - Visual Evaluation of the Event	Daily/Hectar substandard	100.00
		Grass full of weeds	AP24	Visual Evaluation of the Event	Daily/m2 substandard	10.00
		Lack of vegetation cover	AP23	Visual Evaluation of the Event	Daily/m2 substandard	10.00
Structures		Broken guard rails	AP35	PD18 - Visual Evaluation of the Event	Daily/m substandard	10.00
		Obstruction of surface drains	AP34	PD16 - Visual Evaluation of the Event	Daily/work	10.00
Safety	Barriers and Fenders	Missing/broken barriers with risk to traffic	AP40	PD18 - Visual Evaluation of the Event	Daily/m	340.00
		Missing/broken fenders with risk to traffic	AP40	PD18 - Visual Evaluation of the Event	Daily/m	340.00
Signing	Vertical and Overhead Signs	Dirty Signs	AP48	PD12 - Visual Evaluation of the Event	Daily/Facility	1.00
Drainage	Surface and Cross Drains	Dirty surface or obstructed drainage systems	AP56	PD16 - Visual Evaluation of the Event	Daily/m	10.00
			AP57	PD16	Daily/m	3.00
Lighting and Electrical Installations		Broken lamps, flourescent tubes and fixtures		PD19 - and CREMA Standing Orders	Daily/Unit	10.00
Earthwork and Retaining Works	Earthworks(**)	Landslides (1)	AP50/52	PD22 - Visual Evaluation of the Event	Daily/ m3 of earth	10.00
		Cracks or subsidence in pavement & shoulders		PD22 - Visual Evaluation of the Event	Daily/ m2 of pavement	10.00
		Erosion in slopes of cuts (1)	AP50	PD22 -Visual Evaluation of the Event	Daily/ m3 of earth	1.00
		Erosion of slopes of embankments	AP51a	PD22 -Visual Evaluation of the Event	Daily/ m2 of embankment	20.00
		Erosion at the base of structure foundations	AP51b	PD15 - Visual Evaluation of the Event	Daily/m3 of earth	10.00

(*) As from the end of the third month in the sections of routine maintenance (where are not predicted rehabilitation works) and after completion of the various Initial Repairs in the remaining sections
(**) Problems caused by lack of maintenance, negligence or inadequacy of the drainage facilities
(1) Removal of material and immediate cleaning of the pavement
(2) After completion of the rehabilitation works on the section
(3) To be applied after expiry of the time allowed for correction, to each period indicated.

ANNEX 6: LATEST CREMA MAINTENANCE STANDARDS AND INDICATORS

Latest CREMA at the Federal level is now composed of 11 indicators for initial recuperation, 16 for maintenance, 2 for rehabilitation, IRI and deflection.

1. **Table 6.1. – Performance standards (extract)**

CHART 2.1 – Performance Standards for Maintenance Services

Reference Element	Indicator	Required Standard	Code
Road Surface	Potholes (*)	As from the end of the 6th month of the contract, potholes of any size won't be admitted.	**PD 05**
	Sinking & depressions	As from the end of the 6th month, sinking and depressions won't be admitted, as they may endanger user safety.	**PD 06**
	Cracking	As from the end of the 36th month, Cracks Class 2 and Class 3 won't be admitted, until the end of the contract.	**PD 07**
	Wheel ruts	As from the end of the 36th month, Deflections of Wheel Ruts over 10 mm won't be admitted, until the end of the contract.	**PD 08**
Shoulders	Obstacles or hazardous materials	As from the end of the 3rd month of the contract, obstacles or material deposits on the shoulders won't be admitted, as they may endanger the operational safety.	**PD 09**
	Potholes and severe deformations	As from the end of the 6th month of the contract, potholes and severe deformations on the shoulders won't be admitted.	**PD 10**
Drainage	Drainage existence and operation	As from the end of the 6th month of the contract, accumulation points or water crossing on the roadway won't be admitted.	**PD 11**
		As from the end of the 6th month of the contract, the preexisting drainage devices should be clean and in adequate operational conditions.	**PD 12**
Drainage	Drainage existence and operation	As from restoration, all drainage devices should be clean and in adequate operational conditions.	**PD 13**
Signaling	Vertical signaling existence/operation	As from the end of the 6th month of the contract, all vertical signaling should be implanted and in adequate operational conditions, including the kilometer landmarks.	**PD 14**
	Horizontal signaling existence/operation	As from the end of the restoration (36th month of the contract), all horizontal signaling should be implanted and in adequate operational conditions.	**PD 15**
Devices and Complementary Works	Guard-rails, barriers and parapets existence and operation	As from the end of the 6th month of the contract, all parapets, guard-rails and barriers should be implanted, clean and in adequate operational conditions.	**PD 16**
	Fences existence and operation	As from the end of the 12th month, all fences expected in the Cadastre should be implanted and in adequate operational conditions.	**PD 17**
Right-of-Way	Cleaning	As from the end of the 3rd month of the contract, the right-of-way should be kept clean.	**PD 18**
	Grass cutting activity schedule	As from the end of the 3rd month of the contract, the right-of-way should be cleared. Two (2) grass cuttings should be carried out per year in all the highways' right-of-way.	**PD 19**
	Occurrence of critical environmental obstructions	As from the end of the 12th month of the contract, the right-of-way should be free from critical environmental obstructions.	**PD 20**

(*) – Execution of spot repairs is an obligation to be performed within the concept of "technical repair", which requires site cleaning after clearance, edge correction, line painting (marking) and recuperation with asphaltic material duly gauged, mixed and rolled.

2. Table 6.2. - Indicators for maintenance (extract)

CHART 2.2 - Measurement Criteria for Routine Maintenance Services (2nd Year and subsequent ones)

ACCEPTANCE				PAYMENT FACTOR		
REFERENCE ELEMENT	**INDICATOR**	**WEIGHT**	**REQUIRED STANDARD**	**CONFORMING EXTENSION**	**% OF EXT.**	**FACTOR**
Road Surface	Potholes	20%	PD05	1	100	20
	Sinking and Depressions	7%	PD06	1	100	7
	Cracking	5%	PD07	1	100	5
	Wheel ruts	5%	PD08	1	100	5
Shoulders	Obstacles or hazardous materials	3%	PD09	1	100	3
	Potholes and severe deformations	5%	PD10	1	100	5
Superficial Drainage	Drainage existence and operation	7%	PD11	1	100	7
		10%	PD12	1	100	10
Deep Drainage	Drainage existence and operation	3%	PD13	1	100	3
Signaling	Vertical signaling existence/operation	3%	PD14	1	100	3
	Horizontal signaling existence/operation	10%	PD15	1	100	10
Complementary Works and Devices	Guard-rails, barriers and parapets existence and operation	3%	PD16	1	100	3
	Fences existence and operation	3%	PD17	1	100	3
Right-of-Way	Cleaning	3%	PD18	1	100	3
	Periodical grass cutting activities addressed.	10%	PD19	1	100	10
	Occurrence of critical environmental obstructions	3%	PD20	1	100	3
			PAYMENT FACTOR (% of maintenance item)			100

Note: The reference unit for the network survey is according to km, related to the existence of the reference element. The measurement of the maintenance parcel corresponding to the reference element cannot be performed if the corresponding work schedule is delayed, unless there is a justification accepted by DERBA.

Thus, the stretch evaluation should be carried out kilometer by kilometer, checking all the indicators. If at the check point the performance standard indicators are met, the stretch is deemed accepted (CONFORMING); in case of a problem in the indicator at any point in that kilometer, the 1 km stretch is deemed inadequate (NONCONFORMING).

The next chart shows a maintenance evaluation example for a hypothetical 10 km stretch, including the payment factor calculation based on the detected nonconformities.

3. **Table 6.3. – Example of performance monitoring evaluation**

MAINTENANCE CONDITION MONTHLY CONTROL

COMPANY:	name 01	EXTENSION:	10 KM	EVALUATION DATE:	June 2, 2005
BATCH:	B - 01	STRETCH:	CITY A - CITY B		
HIGHWAY:	BA-999	SEGMENT:	KM 10.5 TO 20.5	REFERENCE MONTH/YEAR:	May/05

Segment			Road Surface				Shoulders		Superficial Drainage		Deep Drainage	Signaling		Devices and Complementary Works		Right-of-Way		
Initial km	Final km	Ext. (km)	Pitholes	Settlements	Cracks	Wheel Rut	Obstacles/ hazard mat.	Pitholes and serious deformations	Points of Water Accrual or Crossing	Soundness & Cleaning	Existence & Operation	Vertical	Horiz.	Guard-rail, barrier & parapet	Fences	Cleaning	Clearing	Critical environ. Passive
			PD05	PD06	PD07	PD08	PD09	PD10	PD11	PD12	PD13	PD14	PD15	PD16	PD17	PD18	PD19	PD20
10.5	11	0.5								X								
11	12	1	X															
12	13	1					X				X	X			X			
13	14	1																
14	15	1			X													
15	16	1		X													X	
16	17	1	X					X										
17	18	1																
18	19	1																
19	20	1			X									X				
20	20.5	0.5		X							X							
km of nonconformities			2	1.5	2	0	1	1	0	0.5	1.5	1	0	1	1	0	1	0
% of nonconformities			20%	15%	20%	0%	10%	10%	0%	5%	15%	10%	0%	10%	10%	0%	10%	0%
% of conformities			80%	85%	80%	100%	90%	90%	100%	95%	85%	90%	100%	90%	90%	100%	90%	100%
Factor			20	7	5	5	3	5	7	10	3	3	10	3	3	3	10	3
Factor x % of conformities			16	5.95	4	5	2.7	4.5	7	9.5	2.55	2.7	10	2.7	2.7	3	9	3

Note: The mark "X" represents NONCONFORMITY.

PAYMENT FACTOR (% of maintenance item): 90.3

ANNEX 7: CREMA ULTIMATE CATALOGUES OF REHABILITATION SOLUTIONS AT THE FEDERAL LEVEL

Table 7.1. – Asphalt concrete

IRI / VMD	N (USACE)	IRI<=3				3 < IRI <= 4				4< IRI <= 5,5				IRI > 5,5			
		IGG<=20	IGG >20	IGG<=20	IGG >20	IGG< =60	IGG >60	IGG<=60	IGG >60	IGG < =100	IGG >100	IGG <=100	IGG >100	IGG < =150	IGG >150	IGG <150	IGG >150
		Defl<Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm	
VMD < 1000	< 6,9E+06	LG	F5(5%) + LG	Hx	F5(5%) + Hx	F5(10%) + Micro(1,5)	F5(20%) + Micro(1,5)	F5(10%) + Hx	F5(20%) + Hx	F5(20%) + REP + Micro(1,5)	F5(30%) + REP + Micro(1,5)	F5(20%) + REP + Hx	F5(30%) + REP + Hx	FR5(100%) + REP + H4	FR5(100%) + REP + TSDpol + H4	FR5(100%) + REP + TSDpol + Hx	REC5
Acostamentos		TSD		Reest. de base+TSD		Reest. de Base+TSD(10%) TSD(90)%)		Reest. de base+TSD		Reest. de Base+TSD(20%) TSD(80)%)		Reest. de base+TSD		Reest. de Base+TSD(30%) TSD(70)%)		Reest. de base+ TSD	REC+TSD
		Defl<Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm	
1000 ≤ VMD < 2000	≥ 6,9E+06 < 1,43E+07	LG	F5(5%) + LG	Hx	F5(5%) + Hx	F5(10%) + Micro(1,5)	F5(20%) + Micro(1,5)	F5(10%) + Hx	F5(20%) + Hx	F5(20%) + REP + Micro(1,5)	F5(30%) + REP + Micro(1,5)	F5(20%) + REP + Hx	F5(30%) + REP + Hx	FR5(100%) + REP + H4	FR5(100%) + REP + TSDpol + H4	FR5(100%) + REP + TSDpol + Hx	REC7
Acostamentos		TSD		Reest. de base+TSD		Reest. de Base+TSD(10%) TSD(90)%)		Reest. de base+TSD		Reest. de Base+TSD(20%) TSD(80)%)		Reest. de base+TSD		Reest. de Base+TSD(30%) TSD(70)%)		Reest. de base+ TSD	REC+TSD
		Defl<Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm	
2000 ≤ VMD < 3000	≥ 1,43E+07 < 2,14E+07	LG	F5(5%) + LG	Hx	F5(5%) + Hx	F5(10%) + H3	F5(20%) + H3	F5(10%) + Hx	F5(20%) + Hx	F5(20%) + REP + H3	F5(30%) + REP + H3	F5(20%) + REP + Hx	F5(30%) + REP + Hx	FR5(100%) + REP + H5	FR5(100%) + REP + TSDpol + H5	FR5(100%) + REP + TSDpol + Hx	REC8
Acostamentos		TSD		Reest. de base+TSD		Reest. de Base+TSD(10%) TSD(90)%)		Reest. de base+TSD		Reest. de Base+TSD(20%) TSD(80)%)		Reest. de base+TSD		Reest. de Base+TSD(30%) TSD(70)%)		Reest. de base+ TSD	REC+TSD
		Defl<Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm	
3000 ≤ VMD < 5000	≥ 2,14E+07 < 3,57E+07	LG	F5(5%) + LG	Hx	F5(5%) + Hx	F5(10%) + H3	F5(20%) + H3	F5(10%) + Hx	F5(20%) + Hx	F5(20%) + REP + H3	F5(30%) + REP + H3	F5(20%) + REP + Hx	F5(30%) + REP + Hx	FR5(100%) + REP + H5	FR5(100%) + REP + TSDpol + H5	FR5(100%) + REP + TSDpol + Hx	REC9
Acostamentos		TSD		Reest. de base+TSD		Reest. de Base+TSD(10%) TSD(90)%)		Reest. de base+TSD		Reest. de Base+TSD(20%) TSD(80)%)		Reest. de base+TSD		Reest. de Base+TSD(30%) TSD(70)%)		Reest. de base+ TSD	REC+TSD
		Defl<Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm	
VMD ≥ 5000	≥ 3,57E+07	LG	F5(5%) + LG	Hx	F5(5%) + Hx	F5(10%) + H3	F5(20%) + H3	F5(10%) + Hx	F5(20%) + Hx	F5(20%) + REP + H3	F5(30%) + REP + H3	F5(20%) + REP + Hx	F5(30%) + REP + Hx	FR5(100%) + REP + H5	FR5(100%) + REP + TSDpol + H5	FR5(100%) + REP + TSDpol + Hx	REC10
Acostamentos		TSD		Reest. de base+TSD		Reest. de Base+TSD(10%) TSD(90)%)		Reest. de base+TSD		Reest. de Base+TSD(20%) TSD(80)%)		Reest. de base+TSD		Reest. de Base+TSD(30%) TSD(70)%)		Reest. de base+ TSD	REC+TSD

Nota:

FR5 = fresagem de 5cm
F5 = fresagem + reposição de 5cm
REP = reperfilagem com massa fina de CBUQ e= 2cm
LG = lama asfáltica grossa
Micro = micro revestimento asfáltico em duas camadas (1,5cm)
TSDpol = tratamento superficial duplo c/ polímero
REC e = reconstrução através de reciclagem de Base+ revestimento com espessura de CBUQ = e
Reest. de base = reestabilização de base com adição de 10cm de material
TSD = tratamento superficial duplo
Hx = camada de CBUQ com espessura x, onde x = 40 log DP/Dadm

Table 7.2. – *Surface treatment*

IRI / VMD	N (USACE)	IRI<=3				3 < IRI <= 4				4< IRI <= 5,5				IRI > 5,5			
		IGG<=20	IGG >20	IGG<=20	IGG >20	IGG< =60	IGG >60	IGG<=60	IGG >60	IGG < =100	IGG >100	IGG <=100	IGG >100	IGG < =150	IGG >150	IGG <150	IGG >150
		Defl<Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm	
VMD < 1000	< 6,9E+06	RP(1%)+ LG	RP(3%)+ LG	RP(1%)+ Hx	RP(3%)+ Hx	RP(3%)+ TSDpol	RP(5%)+ TSDpol	RP(3%)+ Hx	RP(5%)+ Hx	RP(5%) + REP + TSDpol	RP(10%)+ REP + TSDpol	RP(5%) + REP + Hx	RP(10%)+ REP + Hx	RP(10%)+ REP + TSDpol	REC5	RP (15%) + REP + Hx	REC5
Acostamentos		TSS		TSD		Reest. base + TSS(10%) TSS (90%)		Reest. base + TSD		Reest. base + TSS(20%) TSS (80%)		Reest. base + TSD		Reest. base + TSS(30%) TSS (70%)	REC + TSD	Reest. base + TSD	REC + TSD
		Defl<Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm	
1000 ≤ VMD < 2000	≥ 6,9E+06 < 1,43E+07	RP(1%)+ LG	RP(3%)+ LG	RP(1%)+ Hx	RP(3%)+ Hx	RP(3%)+ TSDpol	RP(5%)+ TSDpol	RP(3%)+ Hx	RP(5%)+ Hx	RP(5%) + REP + TSDpol	RP(10%)+ REP + TSDpol	RP(5%) + REP + Hx	RP(10%)+ REP + Hx	RP(10%)+ REP + TSDpol	REC7	RP (10%) + REP + Hx	REC7
Acostamentos		TSS		Reest. base + TSD		Reest. base + TSS(10%) TSS (90%)		Reest. base + TSD		Reest. base + TSS(20%) TSS (80%)		Reest. base + TSD		Reest. base + TSS(30%) TSS (70%)	REC + TSD	Reest. base + TSD	REC + TSD
		Defl<Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm		Defl< =Dadm		Defl>Dadm	
VMD ≥ 2000	≥ 1,43E+07	RP(1%)+ LG	RP(3%)+ LG	RP(1%)+ Hx	RP(3%)+ Hx	RP(3%)+ TSDpol	RP(5%)+ TSDpol	RP(3%)+ Hx	RP(5%)+ Hx	RP(5%) + REP + TSDpol	RP(10%)+ REP + TSDpol	RP(5%) + REP + Hx	RP(10%)+ REP + Hx	RP(10%)+ REP + TSDpol	REC8	RP (10%) + REP + Hx	REC8
Acostamentos		TSS		Reest. base + TSD		Reest. base + TSS(10%) TSS (90%)		Reest. base + TSD		Reest. base + TSS(20%) TSS (80%)		Reest. base + TSD		Reest. base + TSS(30%) TSS (70%)	REC + TSD	Reest. base + TSD	REC + TSD

Nota:

RP = reparo profundo
REP = reperfilagem com massa fina de CBUQ e= 2cm
LG = lama asfáltica grossa
TSDpol = tratamento superficial duplo c/ polímero
REC e = reconstrução através de reciclagem de Base+ revestimento com espessura de CBUQ = e
Reest. base = reestabilização de base com adição de 10cm de material
TSS = tratamento suoerficial simples
TSD = tratamento superficial duplo
Hx = camada de CBUQ com espessura x, onde x = 40 log DP/Dadm

ANNEX 8: GOIAS MAINTENANCE PERFORMANCE BASED CONTRACTS EXPERIENCE

The Terceira Via Program

1. The State of Goiás initiated in 2001, with its own resources, a program called "*programa terceira via*", consisting of contracting to the private sector the routine maintenance of the total State road network of approximately 19,500 km, including 7,500 km of paved and 12,000 km of unpaved roads.[51] The contracts were initially signed for a three-year period which was extended for 2 more years.

2. The main features of the program were:

- result-based contracts based on two types of objectives: (i) absence of measurable specific defects (for example, potholes on paved roads, height of vegetation on the road sides, and so on) and (ii) contractual yearly objectives for implementing specific services detailed in a monthly program agreed with the Transport and Works Agency (Agência Goiana de Transportes e obras -AGETOP) regional representative (for example, crack sealing of specific road sections at specific periods, re-graveling of specific unpaved sections at specific periods, and so on). The non-compliance with the contractual requirements would lead to pre-defined daily fines on the monthly payment beginning on the notification day until the observed defect is treated;
- regional contracts, each contractor being responsible for the routine maintenance of all state roads in a determined region.

3. The contract was awarded following a quality/price based evaluation (70/30). The quality criteria were designed to ensure contractors performed field visits and included: familiarity with the activities, specific experience of the contractor, familiarity with the road network features, proposed work plan, availability of equipment, staff and company certificates. The price criteria were based on proposed total annual price for maintenance of both paved and unpaved networks of the region.

4. The services mainly included:

- on paved roads
  - systematic pothole repair within 24 hours
  - systematic edge break and deformation correction within 3 days
  - crack sealing following a pre-established program within 2 days
  - vertical and horizontal road signing recuperation within 3 days
- on unpaved roads
  - platform reshaping within 7 days
  - re-gravelling in specific locations (steep slopes, bridge junctions and so on) within 7 days
  - localized interventions to eliminate critical points within 24 hours
  - mix and wooden bridges routine maintenance
- maintenance of the side vegetation, embankments and right of way
- maintenance of the drainage systems and concrete bridges.

[51] The actual respective lengths are 9,200 km of paved roads and 10,200 km of unpaved roads, as a result of the government paving program over the past 6 years.

5. 26 routine maintenance contracts were awarded at an average cost of R$1,500/km/year on unpaved roads and R$3,000/km/year on paved roads and one supervision contract. The total cost of the program, initially R$222.5 million, reached R$271.5 million at the end of the term, taking into account price readjustments. The total amount of fines during the period reached R$5.5 million, or less than 2.5 percent of the total contract price. Contractors were paid on a monthly basis, composed of the adjusted price and deducting eventual fines. The supervision was done by the 26 AGETOP regional engineers with the support of the consulting supervisor.

6. The first experience was considered successful by the government, and the program, renewed in 2006, was expanded, including adaptations resulting from the experience of the first 5 years of implementation, and new initiatives. The second "*terceira via*" program is comprised of 31 contracts:

- 20 larger regional lots of routine maintenance following roughly the implementation processes of the first phase supervised by 20 AGETOP regional engineers and the supervisor consultant,
- 6 regional lots of periodic maintenance supervised by the remaining 6 AGETOP regional engineers supported by the supervisor consultant,
- 1 lot to support AGETOP in the supervision of the 30 contracts,
- 1 lot for road signing, including maintenance of approximately 1,000 km per year,
- 1 lot for the maintenance of the state airports paved runways, and
- 2 lots for surveys, one for traffic evaluation, the other for road condition evaluation, mainly including roughness, continuous defect visual evaluation and deflections.

7. The contracts' duration is 5 years. Due to budgetary cuts in a tight financial situation for the state in 2006-2008, only the 20 routine maintenance lots have been awarded so far. In addition to annual expenses in routine maintenance expected to reach R$72 million, R$30 million per year would be put towards periodic maintenance and program full execution would reach R$110 million per year (at 2006 prices).

8. The main differences on the routine maintenance lots concerned (i) the initial duration of the contracts, 5 years instead of 3, and (ii) the inclusion of technical specifications and a catalogue of technical solution detailing the repair processes, so as to ensure adequate treatments of the defects. The observed average prices resulting from the bidding are therefore 4800 R$/km on paved roads and 2400 R$/km on unpaved roads.

9. The periodic maintenance lots aim to treat 100 to 120 km per year and region, for a total of approximately 600km p.a., through the localized implantation of thin asphalt layers with or without pavement reshaping. The expected main output is an absence of any defect two years after works execution. Interventions on road sections will follow a monthly program agreed with AGETOP's representative at the beginning of each year, with respect to the contractual yearly objectives.

10. The overall program will require a relatively good capacity of rehabilitation and maintenance programming so as to avoid potential waste of resources (for example, road marking covered by thin asphalt layer, thin asphalt layer on a portion rehabilitated within the period of the contract, and so on).

ANNEX 9: MINAS GERAIS PROMG PROGRAM

Program objective

1. The state road network, totaling approximately 21,500 km, is composed of approximately 13,500 km of paved roads and 8,000 km of unpaved roads. Road maintenance over the past 10 years has been characterized by (i) an important decrease in investments up to 2003, though even in periods of strong budget contractions, such as in 2002/2003, minimum spending has been maintained (with the lowest level being approximately R$20 million per year[52]), (ii) emergency maintenance programs in 2006 and 2007 (so called "*tapa buraco*" – filling potholes programs) designed as an immediate (but not sustainable) response to the important deterioration of the network resulting from the past backlog of the absence of investments in maintenance and rehabilitation; (iii) rather erratic investments in rehabilitation until 2004; and (iv) the initiative of a new program of multi-year rehabilitation and maintenance contracts evaluated on performance launched in 2006 - ProMG.

2. The ProMG program was designed to respond to a relatively severe backlog in road maintenance partially due to the lack of adequate planning and discontinuous resource flows in a period of scarce public resources (2001-2004). It was first launched as a pilot in 2006 in the administrative region of the state capital Belo Horizonte, then has been progressively expanded to other regions. It is now fully integrated in the state's medium/long term strategy regarding road management which envisions (i) a progressive implantation of the ProMG program to reach 50 percent of the territory (and 70 percent of the paved network by 2001), (ii) a progressive transfer to the private sector through concessions and/or PPP of the most trafficked roads, including actual sub-networks under ProMG contracts, once terminated (the ProMG program would then be extended to other regions of the state); (iii) localized rehabilitations on the network not covered either by concession/PPP or ProMG contracts; and (iv) maintenance of the unpaved network separately by the DER.

Program main characteristics

3. The Pro-MG approach is relatively similar to the CREMA contracts in use at the federal and Rio Grande do Sul levels. It aims at transferring the rehabilitation and maintenance of a portion of the paved network to a contractor under a long term (4 years) performance based contract. Contract activities are composed of:

- a preliminary phase to addressing the maintenance backlogs including drainage maintenance, temporary signaling and localized recuperations of the pavement, executed during the first 4 months for approximately 5 percent of the contract total cost (R$8,600/km on average),
- a "functional" phase to rehabilitate road structures, executed during the 12 to 18 months immediately following the preliminary phase for approximately 65 percent of the contract total cost (R$130,000/km), including the cost of bitumen, (rehabilitation standards are relatively light and correspond to short to medium term restoration of the pavement)
- routine maintenance of the network during the program's four years, where performance is measured by a set of indicators, at approximately 30 percent of the contract cost (R$7,900/km/year). Additionally, the contractor is responsible for annual surveys of pavement conditions (deflections, LVC) and of traffic.

4. Contract length average 460 km at an average price of R$60.5 million (including restoration, rehabilitation works, maintenance; cost of bitumen is paid separately). Payments for the rehabilitation phase are based on the number of kilometer of road effectively rehabilitated on the basis of global prices. The maintenance is paid by month and kilometer subject to the respective standards of quality defined by a set of indicators check by the supervision (see a sample of indicators in Table 9.1).

[52] This level is however, largely insufficient to appropriately maintain the entire network in adequate conditions and prevent future deteriorations

Table 9.1. – ProMG indicators

Indicator	Stated period for correction	Fine	
		Reference	Value
Pothole	48 hours	Daily/hole	3.030 UFEMG
Deformation	48 hours	Daily/hole	6.490 UFEMG
Erosion of slopes	1 month	Daily/occurrence	1.300 UFEMG
Missing sign plates	5 days	Daily/unit	2.160 UFEMG

1 UFEMG=16,175 Reais

Source DERMG, The World Bank

Program Status

5. By 2008, 11 contracts will be underway covering close to 5,100 km of the paved network. 10 further contracts are expected to be signed by 2011 (Table 9.2).

Bank's recommendation for program efficiency improvement

6. Taking stock of the experience accumulated at the federal and state levels on CREMA, the Bank, in the preparation of its assistance to the state road agency in the framework of the Bank's project "Minas Gerais Partnership for Development," recommended some improvements in the design of the program, including:

- Improved technical standards for rehabilitation works (up to 10 years) to (i) ensure long term sustainable restoration of the pavement conditions and (ii) avoid potential difficulties between the road agency (DER) and the contractors;
- Extended duration of the contracts, to five years as a first step (corresponding to the maximum legal amount under the actual laws) with the perspective to further extend the duration (subject to the possibility of using the provisions of the state PPP law);
- Refined monitoring and evaluation of rehabilitation works thanks to the application of the concept of "globalized" prices for rehabilitation per technical solution (for example, earthworks, cuts, backfills and carriageway) rather than global price by km of road restored. ;
- Adoption of a catalogue of typical technical solutions to guide designers and allow standardization of projects and improved projects' overall quality.

Table 9.2. – ProMG program

COORD.		2006		2007		2008		2009		2010		Total	Total	Total
Maintenance	MR$ km	Spending Rehab	MR$ km	Spending Rehab	MR$ km	Spending Rehab	MR$ km	Spending Rehab	MR$ km	Spending Rehab	MR$ km	Works (MR$)	Bitumen (MR$)	(MR$)
01a. CRG	2.48		36.00		17.76		2.48		2.48		0.41	**48.11**	**11.02**	**59.13**
	347.10		322.24		24.86									
(2nd. INTV.)	3.51										29.18	**27.84**	**11.26**	**39.10**
	581.70										184.53			
20a. CRG	2.53		12.25		39.13		3.14		2.53		1.27	**42.16**	**16.16**	**58.32**
	369.20		105.00		264.20		6.57							
(2nd. INTV.)	2.44										12.92	**12.43**	**4.16**	**16.60**
	455.90										77.06			
16a. CRG	2.54				9.28		21.54		7.69		2.54	**30.99**	**11.55**	**42.53**
	311.53				140.00		108.33		63.20					
24a. CRG	2.81				9.75		29.61		11.72		2.81	**41.79**	**14.19**	**55.98**
	355.16				100.00		153.10		102.06					
03a. CRG	3.39				10.62		30.22		14.24		3.39	**44.55**	**16.46**	**61.01**
	412.20				58.00		202.17		151.63					
19a. CRG	3.65						27.89		35.58		8.56	**53.57**	**22.10**	**75.67**
	460.50						191.88		230.25		38.38			
15a. CRG	3.52						26.96		34.39		8.27	**51.77**	**21.36**	**73.14**
	445.10						185.46		222.55		37.09			
05a. CRG	4.46						27.34		43.49		16.47	**64.73**	**27.02**	**91.75**
	562.90						187.63		281.45		93.82			
30a. CRG	3.25						21.86		29.51		12.00	**46.93**	**19.69**	**66.62**
	410.30						136.77		205.15		68.38			
10a. CRG	4.23						22.37		38.38		21.30	**60.66**	**25.61**	**86.27**
	533.60						133.40		266.80		133.40			
04a. CRG	4.27						19.36		38.76		24.39	**60.91**	**25.87**	**86.77**
	538.90						112.27		269.45		157.18			
17a. CRG	4.62								71.82		16.11	**64.54**	**28.01**	**92.56**
	583.60								493.82		89.78			
23a. CRG	1.75								27.74		6.10	**24.99**	**10.60**	**35.59**
	220.90								186.92		33.98			
12a. CRG	2.58								33.45		15.43	**35.81**	**15.65**	**51.46**
	326.10								225.76		100.34			
29a. CRG	3.68								47.41		22.00	**50.77**	**22.32**	**73.09**
	465.00								321.92		143.08			
40a. CRG	2.37								30.72		14.14	**32.88**	**14.35**	**47.22**
	298.90								206.93		91.97			
11a. CRG	2.88										47.43	**36.88**	**17.44**	**54.32**
	363.30										333.03			
25a. CRG	4.27										70.36	**54.64**	**25.87**	**80.51**
	538.90										493.99			
07a. CRG	4.00										60.19	**50.72**	**24.23**	**74.95**
	504.80										420.67			
18a. CRG	3.66										51.37	**46.49**	**22.21**	**68.70**
	462.70										355.92			
31a. CRG	3.73										52.34	**47.37**	**22.63**	**69.99**
	471.40										362.62			

Source DERMG, The World Bank