ASSESSMENT OF ROAD MAINTENANCE
BY CONTRACT

Sergio Miquel and James Condron

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Technical Paper

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This document was prepared by Sergio Miquel, a consultant highway engineer with the World Bank, and James Condron, a maintenance engineer with the U.S. Federal Highway Administration. Asif Faiz, a highways adviser at the World Bank was the task manager.
Assessment of Road Maintenance
by Contract

Sergio Miquel and James Condron

A cooperative study between
the U.S. Federal Highway Administration
and the World Bank

The World Bank
Washington, D.C.
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This study was initiated with the active interest and support of Dr. Thomas Larson, the U. S. Federal Highway Administrator. The objectives of the study were informally discussed with Mr. Bernard Fauveau, Secretary General of the Permanent International Association of Road Congresses (PIARC) and senior highway officials from Belgium (Mr. Jean Reichert), France (Mr. R. Sauteray), Malaysia (Dato Ir. Wan A. Rahman Yaacob), and the United Kingdom (Mr. David Holmes CB) at the Executive Committee Meeting of PIARC in Lisbon in November 1990. They endorsed the concept of the study and agreed to support this international effort. The study was subsequently extended to include the contract maintenance experience in Algeria, British Columbia (Canada), Chile, Kenya, and Pakistan, with the agreement of Messrs. Feghoul, E.A. Lund, Armando Sanchez, Peter Wambura, and Mohsin Shaikh respectively. The Brazil case study is based on a review carried out by Peter Gyamfi.

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This report is the product of a joint research study by the United States Federal Highway Administration and the World Bank to assess contract road maintenance practices in selected countries with the objective of providing operational guidance on planning, budgeting, tendering, and administering such works.

The report presents the findings of the first phase of the study which included a survey of the ongoing experience with contract maintenance in Algeria, Belgium, Brazil, British Columbia (Canada), Chile, England, France, Kenya, Malaysia and Pakistan. The second phase of the study will synthesize the country surveys and other relevant experience into operational guidelines for effective introduction and implementation of road maintenance by contract.

Most of the countries included in this study have made the transition from force account to contract work for selected road maintenance operations within the last decade. Many of these countries continue to retain a substantial force account capability. Their collective experience, thus, serves as a useful guide for countries contemplating execution of road maintenance by contract.

The report describes the reasons for using contract maintenance, the classification of maintenance operations, the selection of work items to be contracted, and the types of contracts used for maintenance works. The procedures for tendering contracts and supervision of works are reviewed. The report compares contract maintenance with force account work and discusses the transition from force account (direct labor) operation to contract maintenance.

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EXECUTIVE SUMMARY

Contracting road maintenance operations is often considered an effective means of separating the planning and control functions of road agencies from the execution of works. Such a separation is deemed necessary to enhance accountability in the use of public funds for road maintenance, and to improve the performance and quality of maintenance activities. Protagonists of contract maintenance assert that all road maintenance operations can be contracted out, while traditional road maintenance managers view contract maintenance as at most a complement to their force account work, mostly to cope with work overload.

The purpose of this investigation was to make an objective assessment of road maintenance by contract through a survey of contract maintenance practices in selected road organizations in both industrialized and developing countries. In some of the selected countries, contract maintenance has been a well-established practice for several years -- Belgium, Brazil, France, England, Kenya and Malaysia, whereas in others the transition to contract maintenance started within the last three to six years -- Algeria, British Columbia (Canada), Chile, and Pakistan.

The main findings of the survey are summarized below:

1. The primary reason for using contract maintenance was to improve the effectiveness of maintenance while accommodating reductions in public employment.

2. The decision to contract out road maintenance was taken in all cases without prior consideration of cost comparisons with force account maintenance.

3. Maintenance operations are packaged for contracting purposes according to the type of work with little distinction made between "routine" and "periodic" maintenance. This distinction is made mostly for budgetary purposes.

4. The most commonly contracted work items corresponded to periodic maintenance operations (overlays, surface treatments, resealing, regravelling, etc.) and some routine maintenance work items (patching and sealing of paved surfaces, grass mowing, vegetation control and drainage maintenance).

5. "Unit price" contracts, modified to suit local circumstances, were by far the most widely used method for contracting road maintenance.
6. Most countries used competitive bidding based on standard bidding documents and technical specifications to contract maintenance works, requiring both performance guarantees and retainage.

7. In most selected countries, the construction industry had been able to assume contract maintenance responsibility in a satisfactory manner. All contracting groups interviewed expressed the need to expand the scope and the duration of the maintenance contracts.

8. There is little hard data available in the countries studied to support the general perception that contract maintenance is more cost-effective than force account. Even when cost information is available, it is difficult to make valid comparisons because of different execution methods, quality standards and accounting practices. However, it is generally accepted that force account work units become more efficient when they have to compete with private contractors.

9. Long term commitments to contract maintenance programs must be made by road agencies to encourage new or increased interest by the private sector. The particular conditions affecting a road agency should be studied carefully to determine an appropriate mix between improved force account and contracting.

10. A smooth transition from force account to contract maintenance requires adequate planning and development of a phased program that can be adjusted to changing circumstances.

11. A close working relationship and detailed exchange of information among the road agency, the contracting industry and professional associations have been major factors in making a successful transition from force account to contracting.

These findings and other relevant experience will be used in the second phase of the study to synthesize the country surveys into operational guidelines for effective introduction, planning, budgeting, tendering and administration of road maintenance by contract.
PART I: MAIN REPORT
I. BACKGROUND

Performance of cost-effective maintenance requires finding new ways of performing maintenance activities at the lowest acceptable cost. One approach is to contract maintenance work as an alternative to accomplishing maintenance programs solely with agency personnel and equipment (force account). Lack of well-trained and specialist staff, poor utilization of plant and equipment, and peak work loads are factors that have compelled maintenance managers to consider contracting out certain road maintenance activities. There is also a growing realization that the planning and control of maintenance work, and hence accountability in the use of scarce maintenance resources, may be enhanced when work is carried out under contract. Past studies by the U.S. Transportation Research Board and the World Bank\(^1\) suggest that maintenance may be a technically viable and cost-effective alternative to force account work for a wide variety of periodic and routine road maintenance activities.

II. STUDY OBJECTIVES

The primary purpose of this investigation is to identify for public road agencies the circumstances in which it may be appropriate to implement road maintenance, both periodic and routine (or preventive and corrective) by contract and to establish the procedures that would be necessary for planning, budgeting, tendering, and administering such work.

The main study objectives are to:

(a) Review and evaluate the experience and approaches to contracting road maintenance in selected countries;

(b) Evaluate the advantages and disadvantages of contracting versus force account work for a variety of periodic and routine maintenance activities;

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(c) Assess the comparative costs, benefits, and quality of maintenance work carried out by contract and force account;

(d) Identify and describe the various contractual forms and arrangements used for contracting road maintenance work;

(e) Assess the planning, financing, supervision, and administration requirements, including related institutional arrangements for effective preparation and execution of maintenance work by contract; and

(f) Prepare guidelines for planning, budgeting, tendering, supervising, and administering road maintenance by contract, including adjustment/changes to commonly-used contract documents and procedures, standards and specifications.

III. STUDY APPROACH

In December 1990 the U.S. Federal Highway Administration (FHWA) and the World Bank agreed to jointly support this study and designated James Condron (FHWA) and Sergio Miquel (World Bank) to implement it under the guidance of Asif Faiz of the World Bank. After studying information available on the subject in both institutions, a survey form was prepared to be used as guidance of the survey to be carried out in the selected countries. In February 1991, the survey form (Annex B) was sent to the selected countries.

The programmed visits to the countries had to be postponed because of the Gulf war. In April 1991, Mr. Miquel visited Chile, and later in the month the study team visited British Columbia (Canada). From mid-May to mid-June they undertook a mission to Belgium, France, the United Kingdom, Pakistan and Malaysia. Extensive discussions were held in these countries with central and regional road authorities, consultants, and contractors. In Belgium the visit was organized by the Belgian Road Research Center, and in France by the Service D'Estudes des Transports et Autoroutes (SETRA). Other visits were organized by the road authorities of the respective countries. The information for the Algeria and Brazil case studies was obtained by Michel Ray and Peter Gyamfi, both Bank staff members. The information for the Kenya case study was provided by S. N. Otangolo, Chief Engineer (Roads) in Kenya’s Ministry of Public Works.

The country reports were sent for review to the government officials who assisted in the survey and their comments have been taken duly into account. These reports were also circulated to concerned World Bank and FHWA staff for review, and their comments have been incorporated.
IV. MAIN FINDINGS OF THE SURVEY

Based on an analysis of the data and information obtained during the survey, the main findings of this investigation are summarized below:

Reasons for Using Contract Maintenance

(a) In most countries surveyed, the primary reason for using contract maintenance is to improve effectiveness of road maintenance while accommodating reductions in public service employment. In all cases, these reductions are the result of political decisions to reduce the overall size of government and to implement the principle of the subsidiary role of the state.

(b) In the case of Pakistan, the decision to rely on the private sector to perform road maintenance was based on a study that was performed soon after a new agency was created to oversee the national road network.

(c) Other, but much less important, reasons for using contract maintenance in decreasing order of significance are as follows: limitation of force account staff and equipment to satisfy expanding road maintenance demands, need for quick response in emergency situations, desire to avoid diversion of funds to other activities, desire to enhance contracting capacity, and requirements of financing organizations. Kenya is the only country in which the main reason for contracting maintenance was to overcome inadequate availability or poor utilization of force account equipment, and to improve quality of works.

(d) The ability to obtain services at lower cost was often cited as a reason to use contract maintenance. However, none of the selected countries actually carried out comparative studies of the costs of force account versus contract maintenance before initiating the transition from force account.

(e) While data is readily available about unit costs for maintenance work performed by contract, overall, the selected countries collect very little information about the cost of performing work by force account. In fact, Chile is the only country in the survey that uses a comprehensive maintenance cost-accounting system to collect and process force account costs. French "parcs" (maintenance equipment organization at the county level) have good accounting for their own operations. However, concerning total country roads organizations, France is only beginning to gather and evaluate such information on a limited basis. British Columbia began a similar effort, but the issue is no longer relevant following the transition to complete reliance on contract maintenance. A comparison is also not possible in Pakistan for the same reason. Less detailed, project level cost information is
available from local agency force account units in England. The selected
countries, in general, do not appear to be strongly concerned about force account
costs.

Selection of Work Items to be Contracted

(a) The ability to define and measure the work to be performed, and to control the
quality and the amount as well as the location and concentration of work, were
listed as the most common reasons for selection of maintenance items to be
contracted.

(b) Work items most usually contracted are those corresponding to periodic main-
tenance, particularly overlays, surface treatments, resealing, regravelling and
major bridge repair. Routine maintenance work items most usually contracted
include: patching and sealing of paved surfaces, grass mowing, vegetation
control, and drainage maintenance.

(c) In Belgium, France, and England, snow and ice control is considered too critical
an operation to be let to contract.

Classification of Maintenance Operations

(a) The terms "routine maintenance" and "periodic maintenance" are generally
recognized for programming or budgeting purposes. However, for contracting
purposes, many of the selected countries package maintenance operations
according to the type of work, such as maintenance of drainage systems,
pavement, bridges, etc. Often, these packages contain both routine and periodic
work.

(b) In addition, somewhat different methods are used in some developed countries to
classify road maintenance activities. For example, because of the satisfactory
condition of its network, France uses the term "preventive maintenance" to
describe work undertaken to prevent deterioration. It uses the term "curative
maintenance" to classify more substantial work required when preventive main-
tenance has been inadequate.

(c) In some countries, maintenance work is not clearly distinguished from major
capital improvement activities. England uses the term "capital maintenance" to
classify all road works that provide tangible, productive assets which will yield
service beyond the fiscal year in which the work is performed. This would
include some periodic maintenance as well as resurfacing, rehabilitation, restora-
tion, or reconstruction activities. It uses the term "current maintenance" for all
other maintenance activities with a service life span shorter than a year.
Contract Types

(a) "Unit price" contracting is by far the most widely used method for obtaining road maintenance services in the selected countries. Most countries develop contracts with a clearly defined estimate of quantities. All countries allow some flexibility for payment of work quantities significantly beyond those originally estimated. Moreover, all countries have procedures to provide for inclusion of additional work items that are not initially included in the contracts.

(b) Interesting variations of conventional "unit price" contracts are used in some instances. For example, Belgium and France prepare extensive lists of work items to which the agency assigns unit costs in close cooperation with local contractors federations. For a given project, the contract documents identify estimated quantities for a reduced number of these items. The established costs for these items are used to arrive at an overall contract cost, or at costs for generic groups of related work items. Bidders offer percentages above or below the established costs for the total contract cost in France and for each generic group in Belgium. Selection of the successful bidder is based on overall lowest cost. Payment is based on actual quantities, and established prices as adjusted by the contractor's percentage increase or decrease. During execution of the contract, established quantities for specific work items may vary, or new work items not previously quantified may be added, at the pre-established unit price affected by the percentage increase or decrease offered by the winning bidder.

(c) In England, some contracts are based on a theoretical bill of quantities including about 100 work items. Bidders submit unit prices to be applied to this list of quantities. The six bidders who have presented the lowest bids are selected. When the road administration prepares a specific project, it defines the corresponding bill of quantities and computes the unit prices of each one of the selected bidders to determine the corresponding project cost. The contract is awarded to the firm with the resulting lowest cost.

(d) Another interesting development in England is the "lane rental" type contract in which traffic delay costs are taken into account. This contractual arrangement offers the potential of obtaining an exceptionally high rate of maintenance output.

(e) British Columbia makes exclusive use of lump sum contracts for road maintenance in specific areas, defining clearly the work to be performed and the maintenance standards to be achieved. However, these contracts provide some flexibility in the quantities to be executed for certain work items that may exceed the quantities forecasted when the lump sum contracts were estimated, particularly work items needed for emergency works. For this purpose, the lump sum contract shows quantities of those items for which unit prices are established during negotiations. Adjustments are made to the lump sum payments, based on
actual work performed on these items as compared to the estimated quantities. These unit price items contribute about 10% of the typical contract. Lump sum contracts are seldom used for road maintenance in other countries.

(f) The countries that initially used "cost-plus fees" contracts for maintenance works (for instance, Brazil), have ceased to use them because they do not enhance productivity.

(g) In the execution of routine maintenance and minor emergency works Kenya has contracted lengthmen, usually former construction workers, who use simple hand tools to maintain 1.5 to 2.0 kilometers of road close to their homes, working three days per week on days of their choice.

Contract Provisions

(a) Algeria, Belgium, Brazil's DNER, British Columbia, Chile, Kenya, Malaysia, and Pakistan use standard contract documents which may be different for major and minor maintenance work. In France and England, each subdivision or local road agency uses its own standard contract documents. Sometimes several different formats are used for different types of work, and, in general, these standards vary from local agency to local agency.

(b) Routine maintenance and periodic maintenance operations are sometimes contracted separately. This practice is used mostly in Chile, Kenya, and Pakistan and is frequently applied in other selected countries to more complex periodic activities, such as pavement or bridge repair work. In Algeria and Brazil, maintenance contracts for specific road sections (on average 244 km length in Brazil) combine execution of routine and minor periodic maintenance.

(c) Some countries, including England and Malaysia, combine both periodic and routine maintenance activities in contracts that provide maintenance for all roads within geographical areas. British Columbia uses this method exclusively. In fact, in addition to performing the maintenance work, the contractors in British Columbia are responsible for managing the maintenance and operations programs. This includes performing routine patrols and detailed inspections to identify needs, setting priorities, scheduling the work, and public relations.

(d) All selected countries have prepared technical specifications for maintenance works. Overall, the specifications are comparable to those used for construction works. In all cases they are more demanding than requirements set for execution of road maintenance by force account.

(e) Most countries, except Algeria, require performance guarantees based on a certain percentage of the contract value for routine and periodic maintenance:
Brazil 1%; Belgium, Chile and Malaysia 5%; British Columbia about 10%; England up to 12.5%, and Pakistan 20%. In France, it varies from department to department. Retainages of 10% of each payment, until the amount retained reaches 5% of the total contract value are used in Chile and Pakistan. In England, the retainage is 5% until completion of 3% of the contract value. In France, it varies from department to department. No retainage is made in Algeria, Belgium, British Columbia, Brazil, Kenya and Malaysia.

(f) Mobilization advances of up to 20% of contract value are usually authorized in most countries. Warranty periods for maintenance works vary from four months to a year. Chile, Kenya, Malaysia and Pakistan do not require a warranty period for routine maintenance.

Tendering of Contracts

(a) Competitive bidding among prequalified contractors is generally used to tender road maintenance contracts. Most of the selected countries prequalify contractors on either a regional or national basis. Prequalification is typically based on financial capabilities and technical skills, as demonstrated on previous contracts. In France and England, the prequalification procedures vary among the subdivisions or local agencies. The "lane rental" criteria for awarding contracts in England has proven to be highly effective to motivate contractors to increase their rate of output.

(b) The number of bids typically received in response to maintenance tenders varies among the selected countries. In fact, competition sometimes varies dramatically within a country according to location and type of work. Participation is lacking in some isolated areas, as the desert areas of Algeria, the northern and western regions in Brazil, the extreme south region in Chile, the two states on the island of Borneo in Malaysia, and Baluchistan and the Northern Territories in Pakistan. However, in general, the contractors have demonstrated a strong interest in road maintenance projects.

(c) Lengthmen contracts in Kenya are not tendered, they are assigned to local people with prior experience living close to the contract area, and they are supervised closely.

Supervision of Works

(a) Supervision is performed exclusively by in-house staff in Algeria, Belgium, British Columbia, France, Kenya and Malaysia.
(b) Supervision and program administration is performed with strong support from consultants in Brazil, Chile and Pakistan. Consultants administer the entire program for the trunk road system in a few administrative areas of England.

(c) In most countries, the contractor assumes the responsibility for works scheduling and execution, while the supervision is confined mainly to controlling the quality and quantity of works performed and the compliance with specifications and work program. In Belgium, the functions of the supervision include daily scheduling of the works to be performed by the contractor and general directing of the operations. In Pakistan, the field offices retain close control over the works to be performed, identifying priorities and developing monthly work schedules.

**Capability of the Construction Industry**

(a) While it is not an issue in the developed countries, the developing countries have had to take actions to promote the expansion of the contracting industry, particularly of small works. Algeria, Brazil, Chile, Kenya, Malaysia, and Pakistan have established procedures to ensure local participation for routine maintenance contracts. Further, Malaysia has developed an innovative system to provide technical assistance and financing to small contractors for the acquisition of equipment.

(b) Smaller contractors have shown the greatest interest in contract maintenance work. This is particularly the case for routine maintenance activities. In many countries, especially the developed ones, maintenance work requires a substantial amount of investment in equipment and materials.

(c) All contracting groups interviewed expressed the need to expand the scope and duration of the maintenance contracts to allow for capitalization and for the acquisition of specialized equipment.

(d) British Columbia, England, and Malaysia have experience with including all maintenance activities on specific routes or within entire geographical areas in comprehensive maintenance contracts. The contracts initially used by British Columbia had a duration of three years, while those used by England had a duration of 18 months. British Columbia is now using five-year contracts while England is using three-year contracts. Malaysia uses contracts of two-year duration. Contractors in these countries indicated they believe five years is appropriate to provide them with sufficient incentive to invest in costly, specialized equipment.

(e) Chile and France identified a need to make greater use of performance specifications to encourage the use of innovative techniques as well as more efficient modern equipment. Officials in several countries also noted that tendering
procedures should focus on the quality of the offers based on technical issues rather than lowest cost.

Comparison of Contract Maintenance with Force Account

(a) Although there is a general perception that contract maintenance is more cost effective than force account, this survey did not find any study that could prove this assertion beyond doubt. Actually, little information is available about the cost of performing work by force account. None of the selected countries actually performed comparative studies of the costs of force account versus contract maintenance before initiating the transition to increased use of contract maintenance.

(b) Of the selected countries, Chile is the only one that has succeeded in developing a satisfactory cost accounting system and has established reliable unit costs for both force account and contract maintenance work items. The results seem to show that some maintenance operations, on average, are performed by force account at 40% lower costs than by contract. Although force account operations in Chile are efficient, the comparison is not conclusive because force account operations are not performed to the same stringent standards required for similar operations performed by contract. Officials in other countries, including France, noted they believe work can be performed more efficiently by force account. Where cost information is available, comparisons are difficult because of different execution standards. France is developing some studies that should be very helpful for this assessment. Studies carried out in both Brazil and England have established that increased competition in highway maintenance has created substantial savings in annual costs with no deterioration in the quality of works.

(c) Contracting may offer economic and productivity advantages over force account maintenance to agencies that are overstaffed or are otherwise inefficient. However, some agencies, including Chile, and some subdivisions or local agencies in France and England, have significantly increased the efficiency of their force account operations to the point that they claim to be competitive with private sector operations. The Direct Labor Organizations (DLOs) in England compete successfully in open bidding against contractors. However, there is a widespread concern that the competition may not be entirely fair because DLOs may enjoy some hidden advantages, such as: (i) dual role of local road agencies as contracting agency and contractor; (ii) packaging of work items favoring DLOs; (iii) weaker monitoring of DLO contracts and uneven enforcement of work specifications; (iv) advantages in timing of payments; and (v) possible consideration of additional cost of redundancy of DLOs when evaluating the cost of contractors' bids. Algeria has also converted its county force account organizations into Regional Road Enterprises, which compete with private enterprises for road maintenance and other type of works. Competition among
them was restricted and unbalanced at the beginning but is becoming increasingly open and fair.

(d) Contracting offers the advantage of full accountability of maintenance costs and is often considered to offer greater flexibility in managing increasing maintenance demands of expanding networks or rapidly growing traffic.

(e) Opinions on the comparative advantages of force account versus contracting to ensure satisfactory quality of works and to adjust to requirements of emergency works varied substantially in the different countries visited.

(f) A primary conclusion is that the particular conditions and criteria of any road agency should be studied carefully to determine the most adequate mix between improved force account and contracting.

Transition from Force Account to Contract Maintenance

(a) Long term commitments to contract maintenance programs must be made by road agencies to encourage new or increased interest by the private sector. The selected countries have demonstrated this commitment through: (i) consistent budgeting for maintenance (British Columbia, Chile, Malaysia, Pakistan); (ii) consistent or increased funding for contract maintenance (Belgium, British Columbia, Chile, England, Pakistan); (iii) political support for long-term reductions of force account staff (Belgium, Brazil, France, Malaysia); and (iv) transforming government labor forces into autonomous enterprises competing for works with the private sector and making this competition more open and fair (Algeria, England).

(b) In Belgium, Brazil, England, France, Kenya and Malaysia, the transition has been taking place gradually over a number of years. Accordingly, the transition has not posed serious challenges. In these countries, contract maintenance is used primarily to compensate for reductions in highway agency employment (except Kenya). The agencies in Belgium, Brazil, England, and France are being downsized through attrition (long-term restrictions on hiring of new employees). Malaysia is hurrying the process through the use of enticements for early retirement of maintenance workers.

(c) The shift from force account to contract maintenance was much more dramatic in other countries: six years in Chile, three years in Pakistan, rather suddenly during 1988 in British Columbia, and has been evolving for a few years in Algeria. As Chile had reduced its labor force and equipment prior to initiating higher reliance on contracting (which was geared to absorb increasing maintenance demands), no major problems in redundancy of labor or equipment have surfaced. The National Highway Authority in Pakistan had no labor force
or equipment to start with and went directly into contracting maintenance of the main network entrusted to its responsibilities. In Algeria, the labor force has not been reduced, but transferred to competitive enterprises that work more efficiently.

(d) British Columbia, which experienced the most sudden transition, enacted legislation to provide for incentives to encourage force account workers to establish private road maintenance firms, accept employment with contractors, or accept employment elsewhere in government. British Columbia also adopted policies to accommodate the transfer of equipment, facilities, and materials to the private sector.

(e) The most important factors to ensure a smooth transition from force account to contract maintenance are adequate planning and developing of a gradual process that can be adjusted as it advances. The greatest amount of planning was done in those countries where the increase in the use of contract maintenance was the most dramatic. Chile and Pakistan performed extensive planning before initiating their programs, but by far the most thorough and comprehensive planning effort was undertaken by British Columbia.

(f) All the selected countries have given considerable attention to the development of technical specification, bidding procedures, and standard contract documents to provide for an effective expansion of contract maintenance.

(g) The use of consultants for administration of maintenance programs and supervision of works has contributed to the successful introduction or expansion of contract maintenance programs in Chile, Pakistan and some areas within England.

(h) A close working relationship and detailed exchange of information between the road agency and the contracting industry and professional associations have been major factors in the success of the transition from force account to contracting. This collaboration has encompassed actions such as: (i) assurances of stable or steadily increasing budgets for road maintenance over the years, (ii) discussion of technical specifications and contracting and payment conditions, (iii) fostering of small contractors, (iv) development of adequate training programs, and (v) discussion of experiences gained.
V. SUMMARY AND CONCLUSIONS

The most relevant findings of the survey on contract maintenance are summarized below:

- In most countries surveyed, the primary reason for using contract maintenance was to improve the effectiveness of maintenance while accommodating reductions in public employment. In all cases, these reductions are the result of political decisions to reduce the overall size of government.

- None of the selected countries actually carried out comparative studies of the costs of force account versus contract maintenance before initiating the transition from force account. While data is readily available about unit costs for maintenance work performed by contract, overall, the selected countries collect very little information about the cost of performing work by force account.

- Maintenance operations are packaged for contracting purposes according to the types of work with little distinction between "routine" and "periodic" maintenance. This classification is used mostly for programming and budgeting purposes.

- The most commonly contracted work items correspond to periodic maintenance (overlays, surface treatments, resealing, regravelling and major bridge repairs), and some routine maintenance work items such as: patching and sealing of paved surfaces, grass mowing, vegetation control and drainage maintenance. In the developed countries visited, snow and ice control is considered a critical operation that must be performed by force account.

- "Unit price" contracts, modified to suit local circumstances were by far the most widely used method for obtaining road maintenance services in the selected countries. "Lump sum" and "cost-plus fees" contracts are only seldom used.

- Most countries used competitive bidding based on standard bidding documents and technical specifications to contract maintenance works, requiring both performance guarantees and retainage. The "lane rental" awarding criteria has proven to increase contractors efficiency.

- In most selected countries, the construction industry has been able to assume the contract maintenance responsibility in a satisfactory manner. The process was more challenging in Malaysia and Pakistan, but these two countries developed innovative methods to enhance participation by small contractors. In Algeria and Kenya further strengthening of the construction industry is still an issue. All contracting groups interviewed expressed the need to expand the scope and
duration of the maintenance contracts to allow for capitalization and for the acquisition of specialized equipment.

- Although there is a general perception that contract maintenance is more cost effective than force account, there is little analytical data available to support this perception. Even when cost information is available, it is difficult to make valid comparisons because of different execution method, quality standards and accounting practices in the public versus the private sector. Paired with the increase of maintenance contracting, some agencies have managed to increase significantly the efficiency of their force account operations to the point that they claim them to be competitive to private sector operations.

- Long term commitments to contract maintenance programs must be made by road agencies to encourage new or increased interest by the private sector. The particular conditions affecting a road agency should be studied carefully to determine an appropriate mix between improved force account and contracting.

- The most important factors in ensuring a smooth transition from force account to contract maintenance are adequate planning and development of a phased program that can be adjusted to changing circumstances.

- A close working relationship and detailed exchange of information among the road agency, the contracting industry and professional associations have been major factors in making a successful transition from force account to contracting.

These findings and other relevant experience will be used in the second phase of the study to prepare a final report on:

(a) In-depth analysis of requisite conditions for successful preparation and execution of contracted road maintenance programs, including inter alia the following: (i) existence of a well-defined road maintenance program; (ii) suitability and stability of institutional arrangements; (iii) adequacy of construction industry to execute contracted road maintenance, including the presence of a competitive environment; (iv) transition from force account to contracted work, including simulation of market type environment and incentives; (v) procedures for overall and detailed planning, financing, tendering, executing, supervising and monitoring contracted road maintenance; (vi) forms of contract to suit different conditions; (vii) training arrangements for road agency staff and contractors personnel; and (ix) assessment of the quality and cost effectiveness of contracted road maintenance.

(b) Preparation of guidelines on the basic actions to be taken by public road agencies to effectively introduce and implement road maintenance by contract.
PART II. CASE STUDIES
I. INTRODUCTION

In 1984, Algeria took a first step to contracting road maintenance by transferring the force account equipment pool to country-owned contracting enterprises. This measure did not achieve the expected cost saving results mainly because the implementation was not adequately prepared. In 1987 Algeria initiated in seven pilot regional entities the contracting of maintenance with private contractors in open competition with the country- or state-owned enterprises and expanded this program to 28 regional entities in 1990. The entire process is still at an early stage. Many adequate measures have been taken to ease the last transition, but others are still being implemented or should be initiated.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

The Ministry of Infrastructure (MOI) is responsible for the maintenance of the national roadwork (RN) of 26,308 km (22,154 km paved), however, maintenance execution is carried out by the road authorities in the 48 regional entities (wilayas). The 1990 condition survey of the RN indicates that 43% are in good, 31% in fair, and 25% in poor condition. Maintenance of the secondary roads network (wilaya roads, RW) of 27,748 km (18,102 km paved) is mainly the responsibility of the wilaya road authorities. At present, there is no organization specifically responsible for the maintenance of the communal road network of about 40,000 km (18,917 km paved), except for those communal governments that have taken over this responsibility.

The 1990 expenditures in the RN and RW networks amounted to about Algerian Dinars (DA) 4,000 million (US$1 = DA 9.00), of which about 50% was spent on new construction, 25% on pavement strengthening, and 25% on periodic and routine maintenance. In every one of these three expenditure categories about 2/3 were spent on the RN and 1/3 on the RW networks. Of the roughly DA 1,000 million spent on periodic and routine maintenance, about 60% was spent through contracts (mostly with state enterprises), and about 40% by force account.

The MOI discharges its responsibilities on the road sector through two Directorates: a Directorate for Road Construction and Strengthening, and a Directorate for Road Maintenance and Operations which is divided into two sub-directorates for each one of these functions.
Maintenance Organization

The Sub-Directorate for Maintenance (SDM) is divided into three departments: one for planning, one for specifications and standards; and one for equipment. SDM focuses on road maintenance policies, budget and technical issues.

Most responsibilities for maintenance administration and execution rest with the Directorates for Public Works (DTPs) in the 48 wilayas, which are responsible for national roads on behalf of the state and for the wilaya roads on behalf of the wilaya governments. The wilaya government units are politically important and have a considerable degree of autonomy reinforced by the recent decentralization. As they have a strong tradition of self-sufficiency, there is little interdependence among them, economically or administratively. The wilaya government has seven divisions administering different sectors. Among them, the Infrastructure and Investment Division, administers four services, one of them being transport. Up to 1983, the former Basic Infrastructure Directorates (DIBs) performed by force account all maintenance works on the national roads within a wilaya, and on the wilaya roads proper. On January 1, 1984 the DIB equipment pools, with their workshops, operators and mechanical staff, were converted into autonomous Regional Roadwork Enterprises (ETRs) acting as wilaya-owned contractors.

The recasting of the role of the DIB engineers and management staff (without prior preparation) from operation managers to contract managers created problems. Unit prices for road construction operations and for a maintenance operations were set in several wilayas at unreasonably high levels, while unit prices for some maintenance operations were set too low, or were not considered at all. This, coupled with weak planning and lack of supervision, caused imbalances in the execution of maintenance programs and extreme delays in the execution of some maintenance operations.

To help overcome these problems, the Bank, under the Fifth Highway Project, Loan 2808-AL, financed, starting in 1987, periodic pavement and shoulder maintenance and selected routine maintenance operations contracted to private enterprises in seven pilot wilayas. The loan also financed technical assistance to: (a) strengthen the expansion of the National Coordinating Laboratory into a Technical Quality Control Organization (CTTP); and (b) train road maintenance personnel at headquarters, in the DIBs and in the ETRs in matters related to administration and technical execution of road maintenance. After a three year experience the pilot program to contract road maintenance operations with private enterprises in competition with state enterprises has been successful in three wilayas, less successful in two wilayas and rather discouraging in the remaining two. During 1990 the program was expanded to 28 wilayas and is expected to be progressively extended to the remaining 20 wilayas.
Maintenance Planning and Budgeting

The planning functions of both road directorates within MOI are strongly supported by the new Technical Quality Control Organization (CTTP). This autonomous central organization, coordinated with four regional laboratories, replaced, in the recent reorganization, the former central laboratory and the local laboratories. CTTP gathers the information on the road inventories, pavement conditions and traffic needed for planning road construction and maintenance, and is assisting the road directorates in developing an effective pavement management system. The development of this system is also aimed at helping DIBs in the systematic, planning and programming of maintenance operations at the local level, since maintenance planning is still largely decentralized to the wilayas. The wilayas perform their maintenance planning based on evaluation of actual needs.

Budgeting allocations for maintenance of national roads are made by the SDM based on the programs submitted by the DTPs, while global budgetary allocations for the wilayas roads are made by the Ministry of the Interior, also based on DTP’s proposals. The budgetary allocations for road maintenance have been decreasing in real terms over the last 10 years, because annual increases have remained in average below the inflation rate.

III. CONTRACT MAINTENANCE

General

The efforts to carry out maintenance by contract with private enterprises were started in 1987 in seven pilot wilayas and were expanded in 1990 to 28 wilayas. In each wilaya the private enterprises compete with the state owned roadwork enterprise (ETR) of that wilaya and, in many cases, with the ETRs of neighboring wilayas. In the seven wilayas 72% of the maintenance expenditures were disbursed in 1991 through contracts and 28% through force account. Of the total contracted amount, about 50% was awarded to the resident ETR, 25% to neighboring ETRs, and 25% to private enterprises. The maintenance contracts cover mostly periodic maintenance activities for specific paved roads or for all paved roads in an area, and may include also some routine maintenance activities, such as patching, sand sweeping, and ditch cleaning. Sometimes the contracts may cover only specific activities in an area or in a defined location, such as patching, sealing, and surface treatments. The decision to contract maintenance works is taken by the office responsible for maintenance in the DTP, based mainly on the following criteria in decreasing order: (a) amount, location and concentration of work; (b) availability of experienced contractors; (c) expectation of lower cost and higher quality; (d) ability to define and measure works; and (e) availability of resources to plan and to control works.

Unit costs of contracted maintenance operations are recorded and evaluated to establish if the extension of contracting to private enterprises has decreased, in constant terms, the price level compared to contracting on sole source base with wilaya-owned enterprises. Although there is an indication that lower cost levels have been achieved in some of the seven pilot
wilayas, the cost comparisons are not yet conclusive because of increasing inflation. No attempt has been made to establish unit costs of force account maintenance operations.

Contract Provisions

Road maintenance is contracted primarily through "unit price" contracts of up to one year duration. Since funding becomes available only about three months after initiation of the budget year (March 1) and contracts cannot be extended beyond the end of the fiscal year, most contracts have only a real duration of 6 to 9 months, or even less if the bidding process takes some months. Efforts are being made to expand in 1992 the contract period to two years. Maintenance contracts are prepared using a standard format and are based on standard specifications for the execution of periodic maintenance activities. Bills of quantities are clearly defined and unit costs are offered by the bidder. Flexibility is provided during contract execution to change, if necessary, some work quantities or to agree on unit costs for eventual new items, as long as the total contract cost does not exceed the initial amount. In exceptional cases total cost increases of up to 10% may be authorized. If further increases should become necessary, the contractor may request a renegotiation of unit prices. Advance mobilization payments of up to 10% may be granted. At present there are no provisions for price escalation, however, they are under study to be introduced during 1991.

Performance Bond, Guarantee, Retainage and Warranty Period

For maintenance contracts, neither bid, nor performance guarantees are required, in each payment a retainage of 5% is made. The retained amount is returned to the contractor only after final acceptance of works at the end of the one year warranty period.

Tendering of Contracts

Invitations for competitive bidding for maintenance works in the 28 wilayas presently using this procedure are published in the national and local newspapers requesting prequalification of interested bidders. The prequalification procedures used have not been satisfactory and are being reviewed to make them more specific task-oriented.

Participation of contractors in bids has been low, an average of four, including ETRs, in 37 contracts let in 1989 by the seven pilot wilayas. However, one wilaya had an average of 13 participants in six contracts let that year. The whole process from preparation of bid documents to award of contract takes on average 11 weeks, with an additional average period of 6 weeks until initiation of works.

Overall, the contracting industry has demonstrated sufficient interest in contract maintenance in easily accessible areas in which the wilaya authorities have developed reasonable competitive bidding procedures. Satisfactory competition has taken place only in a few wilayas. The whole process needs further strengthening and consolidation.
Supervision

Supervision is carried out by DTP staff through weekly visits and monthly measurement of executed work quantities. CTTP has a global supervision role in behalf of the Ministry. Quality control is executed through permanent laboratory personnel, either from the wilaya laboratory (in a few cases), or from the regional CTTP laboratories. In many cases the quality control is made only of the ingredient materials and not of the end product. Effectiveness of supervision is constrained by lack of skilled personnel and an insufficient number of adequate vehicles.

Payment Procedures

The contractors submit monthly estimates of quantities for payment, which are reviewed by the supervision and at DTP level. In the past, actual payments have been delayed three to four months, actions are being taken to reduce the delay to a maximum of 40 days, after which interests would be paid.

Transition from Force Account to Maintenance

A first step in this transition was the transfer in 1984 of the equipment pool and its personnel, and some managers to the wilaya-owned enterprises. However, this measure did not achieve a real reduction of central government forces nor a substantial improvement in the efficiency of maintenance execution.

The second step, the introduction of contracting maintenance with private enterprises in open competition with the wilaya-owned enterprises in seven pilot wilayas, started only in 1987. The decision for this step was taken for the following reasons, in order of their relative importance: (a) government policy to reduce public employment; (b) inadequate efficiency of force account and of ETR contracting; (c) desire to secure lower costs through open competition; (d) need for specialized equipment and skills; (e) desire to resolve logistic problems; (f) avoidance of diversion of funds to other activities; and (g) desire to enhance contracting capacity and quality of works.

Several actions have been taken to ease the transition from force account to competitive contracting of road maintenance:

- the reorganization of the Ministry of Infrastructure strengthened substantially the maintenance organization and functions, and gave autonomy and more authority to CTTP for supervision of works and quality control;
- adequate pavement conditions analysis and planning of maintenance has been introduced and is being further strengthened;
the supervision capacity at DTP level remains to be strengthened through general training, which is now three years behind schedule;

systematic laboratory control of maintenance works has been initiated and had already a positive impact;

specific training seminars have been offered on: (a) network condition assessment, (b) surface dressing techniques, (c) technical standards and use of sample bidding documents;

a special task force has been created on surface dressing with the best experts from various organizations, a draft surface dressing guideline has been prepared and continuous exchange of experience is underway;

some higher level staff from DDM, CTTP, regional laboratories, and some field engineers have been sent to training abroad;

contractors have been allowed to participate in some training seminars;

prequalification regulations are being upgraded, will consider participation in the training seminars, and may take into account local evaluation of surface dressing equipment by a central team in field missions;

measures are being taken to improve: (a) publication of bids, (b) general contract procurement procedures, (c) avoidance of payment delays, and (d) compliance with agreed execution schedules;

action has been initiated to provide to contractors foreign currency allowances for acquisition of spare parts; and

annual national meetings with contractors have been organized to promote administration/contractor dialogue and a national information day for contract maintenance has been established.

IV. SUMMARY AND CONCLUSIONS

The transfer of equipment pools and its personnel to state-owned contracting enterprises in 1984 was undertaken without adequate planning and the required preparation neither of the staff expected to manage the enterprises, nor of the staff that were to program, contract and supervise the tasks to be performed by the enterprises. It therefore failed to improve noticeably the overall level of maintenance and even caused serious delays in the execution of some maintenance operations.
The experimental transfer to competitive contracting of maintenance works in seven pilot wilayas was better prepared, but has failed so far to produce fully conclusive and sustainable results. It has worked well only in three wilayas where the authorities had clear concepts and took most of the right decisions. The ongoing expansion of this program to 28 wilayas and beyond remains a challenge and requires decisive actions to create the right environment in each wilaya with proper monitoring. Many of the actions required to ensure these achievements have been taken, some are still in early implementation stages and others have not yet been initiated. Recent 1991 bid opening results show positive signs of new small private contractors competition and willingness of the DTPs to award them contracts when they are the lowest evaluated bidders.

It appears that following actions are of utmost importance:

- Improvement of decision making capacity at the ministry level;
- Insurance of adequate maintenance budgets that would offset the effects of raising inflation;
- Administrative measures to allow availability of funds immediately after the start of the fiscal year;
- Avoidance of other type of road works being negotiated at high prices (for example, new rural access roads) which makes real competition for maintenance contracts comparatively unattractive;
- Administrative measures to speed up payments;
- Upgrading and streamlining of prequalification, tendering and contracting procedures;
- Establishment of procedures for adequate payment of price escalation;
- Enforcement of reliable cost-accounting and responsible fiscal and technical management of the wilaya-owned enterprises;
- Further strengthening of the planning, supervision and administration capabilities of DTP’s staff;
- Provision of adequate and sufficient vehicles for mobilization of supervision teams;
• measures to facilitate acquisition of equipment and spare parts by private contractors; and

• consolidation of technical assistance for satisfactory training for public and private maintenance personnel.
BELGIUM

I. INTRODUCTION

Belgium has extensive experience with the use of contract maintenance. The government has used contracting for most routine maintenance and almost all periodic maintenance of the National Road Network for more than 40 years. Only a small portion of the work is performed by force account.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

Prior to 1988, the Ministry of Public Works (Ministere des Travaux Publique de Belgique), through its Roads Administration (l'Administration des Routes) was responsible for administration of the national road network. As of February 1988, this network consisted of about 1567 km of motoroutes and over 12,900 km of other roads (a portion of these roads are also functionally classified as freeways), as well as about 7350 km of cycle tracks. The remaining public roads were maintained by other agencies, predominately the municipalities. The Road Administration included a staff of about 4,950. The program was financed through the Belgian Road Fund (Fond des Routes).

In January 1988, the country was divided into three political regions: Brussels, Flanders, and Wallonia. Many national agencies, including the Roads Administration, were replaced with Regional authorities. In the Flanders Region, the Administration for Road Infrastructure and Transport (Administratie Wegen-Infrastrucuur en Verkeer) of the Department for the Environment and Infrastructure (Department Leefmilieu en Infrastructuur) of the Flemish Executive (Vlaamse Executieve) was established to assume responsibility for about 880 km of expressways, 5,100 km of other roads, and a network of some 6,000 km of cycle tracks. In the Wallonia Region, the General Directorate for Roads and Expressways (Direction Generale des Routes et des Autoroutes) of the Wallon Ministry for Equipment and Transportation (Ministere Wallon de L'Equipment et des Transports) of the Wallonia Regional Council (Counseil Regional Wallon) was created to administer about 780 km of expressways, 6,960 km of other roads, and about 1,320 km of cycle tracks. A third organization was instituted in the Brussels Region to oversee about 20 km of expressways and about 250 km of other roads².

During the reorganization, employees of the former Roads Administration were assigned to the various Regional organizations. About 2025 employees transferred to the Wallonia

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²/The kilometerage of road under various regional authorities reflect the status as of 1990.
Region and some 2900 to Flanders and Brussels. In the Wallonia Region, the General Directorate for Expressways and Roads is subdivided into five General Inspectorships. One oversees programs, traffic, and infrastructure, another oversees management and equipment, and the other three oversee the Provincial administrations. Of these, one comprises road authorities in three Provinces and the two others covering road authorities in two Provinces. Each Provincial administration consists of one administrative, one technical, and one works section. The works sections are further divided into districts (the number varies from 5 to 9). A typical district manages about 250 km of roads with a staff of about 2 engineers and 40 employees, 25 of which are directly involved in execution of force account maintenance works. The districts manage investment projects as well as maintenance contracts. No organization data could be obtained on the Flanders and Brussels Regions.

Maintenance Organization

Maintenance of the nationally significant roads has been performed primarily by contract for at least 4 decades. At present, the Ministries accomplish virtually all periodic maintenance and about 85% of routine maintenance by contract.

Nonetheless, the Ministries retain a labor force, equipment, facilities, and materials to perform some routine maintenance activities such as maintenance of pavement markings, traffic signs (erection, repair, and maintenance), and snow and ice control (removal and spreading of chemicals). They also perform most emergency repairs, particularly temporary repairs to pavements. Some force account units perform other activities, such as mowing or trimming of trees and shrubs.

The flexibility in accomplishing maintenance by either force account or contract provides, in the opinion of the Belgian Road Authority, the following advantages:

- Work can be accomplished using either method. Accordingly, maintenance needs can be met by contract when government forces are busy, and work that otherwise may be performed by contract can be performed by force account during slow periods. This flexibility is acceptable to the contractors because, ultimately, they receive sufficient work to provide for payment of the total value of their contracts.

- Funds can be shifted by the provincial authorities between force account maintenance, contract maintenance, and investment work. Therefore, funds in excess of needs to cover the cost of actual maintenance contracts (budget vs. bids) can be diverted to either force account or investment (primarily resurfacing) work. On the other hand, shortfalls between budget and actual costs for contract maintenance can be absorbed by the other programs.
Maintenance Planning

The Regional road authorities are responsible for maintenance planning. As part of this role, the authorities assess pavement condition, measure pavement smoothness, and collect traffic data. The condition surveys are performed by district personnel every 2 years for expressways and other major roads, and every 4 years for other national roads. Pavement rideability is assessed at the same frequency, by the Division of Infrastructure (Brussels) or the Belgian Road Research Center. Traffic surveys, including number, type, and size of vehicles, are made every 5 years; the continuous traffic information collected on the expressways allows for estimated updating of the survey results.

This data has been integrated into a rather comprehensive pavement management system that is being developed. The system uses an optimization procedure to identify reasonable maintenance strategies. Quite interestingly, this system allows consideration of local political priorities. However, it is not used by the road authorities to establish the regional programs. Instead, it is available as an aid for the field offices. The process to successfully incorporate the pavement management system into the maintenance planning process is still underway.

Maintenance planning is, in fact, performed at the district levels. Maintenance activities are selected based on relative need and availability of funds. District inspectors travel their entire networks each day to identify needs and to schedule maintenance activities by force account and by contract, for both roads and bridges on a daily basis. The districts are responsible for managing the contract maintenance programs, including directing the operations to be performed. The district managers have the option of using either force account or contract to perform needed work.

Detailed information about actual force account accomplishments is not recorded. Instead, figures about the size of maintenance crews and pieces of equipment used at each worksite is entered into maintenance logs. Quantities of work, associated unit costs, and rates of productivity are not calculated. Estimates of unit costs for contract maintenance are based on experience gained from previous maintenance contracts.

Maintenance Budgeting

Prior to establishment of the three Regions, maintenance was funded centrally from the Belgian Road Fund. Now, overall tax revenues, aside from those to provide for services that are still managed at the national level, are divided among the three Regional governments. The Regional governments are responsible for distributing the funds among the various Ministries. Accordingly, the road authorities in each Region compete with many other government programs for funds. Road funds are distributed by the regional Ministries to the Province, and ultimately the district levels. In general, the road maintenance funds are distributed proportionately among the field offices.
Since Belgium carried out a major road construction effort in the 1960s and 1970s, the overall road budget has, in real terms, been reduced rather significantly. In constant terms, the overall road budget for 1987 amounted to about 20% of the expenditures for the peak year, 1972. In 1987 (the last year in which national data was collected) the total road budget amounted to 14,600 million BF, about US$400 million equivalent, of which about 46% was allocated to maintenance. Overall, the road maintenance budgets have remained almost constant in current terms, but as there have been no increases to compensate for inflation, in constant terms, the maintenance budgets have decreased. Officials from two of the Regions noted that they believe funding for road maintenance has been inadequate.

The distinction between routine and periodic maintenance or, more importantly, between maintenance and capital investments, such as resurfacing, reconstruction, or rehabilitation, is not clearly defined. While the Ministries fund maintenance and investment activities separately, both programs are managed in similar fashions. For example, within each Ministry, engineers and technicians in the various district offices are responsible for contract administration and supervision of investment as well as of maintenance works. In fact, similar contracts and procedures are used for both programs. This lack of clear distinctions makes it somewhat difficult to assess real expenditures for maintenance.

III. CONTRACT MAINTENANCE

General

Belgium has been contracting maintenance operations for more than 40 years, without making a clear distinction between routine and periodic maintenance, but stressing the need for preventive pavement maintenance to forestall deterioration, particularly through surface-dressing. At present, almost all periodic maintenance of the National Road Network is being contracted, while about 30% of routine maintenance is carried out by force account. It appears that, overall, the force account resources are not being used efficiently. The size of these resources has been dimensioned to take almost full responsibility for winter maintenance, in the assumption that it cannot be satisfactorily carried out by contractors. The utilization of force account personnel and equipment during the rest of the year is rather low. While the force account units work long hours during the winter, they are used much less productively during the other seasons. Equipment utilization is low and obsolete equipment is not readily disposed of. Ministry officials recognize contracting is probably less costly (which supports their decision to use contracting so extensively) but costs have little influence on the decision to retain force account capabilities.

Contract Provisions

Road maintenance is contracted primarily through "unit price" contracts that include both routine and periodic maintenance activities. Much less use is made of "cost-plus-fixed-fee" or "hourly rate" (equipment or personnel) types of contracts. Lump sum contracts are not used.
Maintenance of expressways and major bridges is administered and supervised at the provincial level. Most other road maintenance operations are contracted at the district level. In general, the following types of contracts are used by the districts:

**Long Term Contracts**

These contracts typically have a duration of about one year. The contract period does not necessarily coincide with the fiscal year. The contracts include routine and periodic maintenance of all district roads, including minor bridges. (See Annex.) The bidding documents include general and specific contract conditions, technical descriptions of the work items, references to a technical specifications book, and a list of work items, estimated unit prices, and quantities.

These "unit price" contracts are especially designed to provide flexibility in the amount of physical quantities of particular work items executed, and for addition of new work items not included in the original bill of quantities. The work items are grouped into eleven chapters, each including from about 8 to 43 work items grouped according to specific types of work. One contract we reviewed (See Annex) includes 273 work items for which the Province established estimated unit prices. However, quantities are given for only 58 of these items (ranging from one to eleven items per chapter). These 58 items were used to define the subtotal value for each chapter as well as the total estimated value of the contract. Bidders are not requested to provide unit prices, but instead, to offer a percentage increase or decrease of the estimated subtotal value for each chapter (these percentages can vary for each chapter). The total bid price is the addition of all modified estimated chapter values plus a Value Added Tax of 17%.

The contract is awarded to the lowest bidder that satisfies the capital and experience requirements. During works execution, work item quantities may change, or work may be added using items to which unit prices, but no quantities, had been assigned. Payment is determined by applying the estimated unit price modified by the percentage decrease or increase offered by the contractor for all unit prices within the corresponding chapter. New unit prices may be negotiated if real quantities are less than one half or more than three times the originally estimated quantities. However, total contract value may not exceed the original contract value by more than 10%. No provisions are made for inflation. Mobilization advance of up to 20% may be requested by the contractor.

The contract does not include an annual work schedule defining a balanced program of works to be carried out monthly. On the contrary, works are carried out as need arises. This may result in heavy concentration of works to be carried out in a short period of time, particularly towards the end of the contract period, and may curtail cost effective use of the contractor’s resources.
Short Term Contracts

These contracts have a typical duration of up to three months. They include mostly periodic pavement maintenance operations on specific sections of roads. They are based on clearly defined work quantities for which the bidders are requested to submit their unit prices, and are handled as typical "unit price" contracts. Variations of work quantities are accepted to a much lower extent than in the long term contracts. Total contract costs are kept, in most cases, at the estimated levels.

Overall, the contract requirements are defined in great detail in the contract documents. To a great extent, the specifications are the same as those used for construction. While the specifications establish specific work methods, the contractors are allowed to propose alternative methods and techniques to increase productivity and efficiency.

While the quality of contract and force account maintenance works are supposed to be similar, frequently this is not the case. To a great extent, this is a reflection of differences in the type of work contracted. For instance, force account units may perform temporary pothole repairs while better-constructed, permanent repairs may be performed by contract at a later date. Further, permanent repairs frequently are performed under improved conditions, and the work may be included as part of a more extensive, comprehensive package of pavement maintenance activities. This complicates any cost comparison between the two methods of performing road and bridge maintenance.

Performance Bond, Guarantee, Retainage, and Warranty Provisions

The contractors are required to provide a performance guarantee equivalent to 5% of the contract price. In addition, the contractors must provide a 1 year warranty on workmanship and materials. Overall, contracts are called back to perform warranty work on about 5% to 10% of the maintenance contracts. It is believed this is an effective incentive to the contractors to consider quality and perform the work properly.

Tendering of Contracts

Maintenance contracts are solicited through open competition. Contractors must be prequalified, based on their financial capability along with previous experience in the type of work (such as bridge work, paving, etc.) being sought. Technical capabilities or level of quality of previous contracts is not considered.

Typically, between 5 and 10 bids are received, although the number is sometimes higher. Many international firms have been awarded contracts. The number of international contractors interested in maintenance work has decreased, though, because there are fewer large construction projects to attract them to Belgium.
Overall, the contracting industry has demonstrated a reasonable amount of interest in contract maintenance. There are no institutional problems, such as budget fluctuations, bidding requirements, bonding or warranty requirements, that constrain the success of the contract maintenance program. In addition, there is a sufficient supply of skilled labor, equipment, and materials.

**Supervision**

Supervision is primarily provided by district office staff. However, engineers from the Provincial offices assist with major projects or those that involve bridges. Full time inspection is used on major maintenance contracts, while spot reviews are used on less complex works. The inspectors monitor quality of work, and they measure quantities to verify payment. Oversight of supervision is provided by engineers at the Province or Ministry levels. Laboratory personnel oversee quality of materials.

**Payment Procedures and Auditing**

The contractors submit monthly estimates of quantities for payment. These estimates are reviewed at the district office level, and compared with notes and quantities recorded by the inspectors. Payment typically is made within 60 days.

A series of audits is completed prior to payment. Financial control of the overall road program is monitored at the Prime Minister level by the Cour des Comptes.

**IV. SUMMARY AND CONCLUSIONS**

The day-to-day detailed scheduling of maintenance works by force account and by contract are not conducive to the most cost-effective use of resources.

The road maintenance budgets have been held constant for several years. Expenditures have decreased significantly in real terms. This may lead to a reduction in levels of service for maintenance in the near future.

In general, the condition of a sample of all categories of roads in the Wallon Region reveals the Ministry has operated a successful road and bridge maintenance program. It is apparent they make great use of surface treatment as a pavement maintenance technique. This demonstrates an emphasis on preventative maintenance.

It appears that force account resources are not being used cost-effectively because they have been dimensioned to take over almost full responsibility for winter maintenance. The utilization of force account personnel or equipment during the rest of the year is rather low. Ministry officials recognize contracting is probably more cost-effective, but costs have little influence on the decision to retain force account capabilities. On the other hand, there seems
to be a public sentiment to reduce the size of government. A hiring freeze has been in place for many years, and the average age of the districts' personnel is relatively advanced. A decision to hire, or to reduce staff and increase contracting, probably must be made within the next years as an increasing number of current employees retire.

Belgium has developed a type of "unit price" contract to provide flexibility in the amount of physical quantities of particular work items executed, and to allow addition of new work items not included in the original bill of quantities.
I. INTRODUCTION

Since 1970, Brazil has increased the use of contracting to carry out the maintenance of its federal road network, reaching a level of 62% of total maintenance expenditures in 1989. In that year, 12% was executed by force account and 26% by delegation to the states and the army. During the first ten years, contracting was done mostly on the basis of "cost-plus fees" and the mechanisms needed for contracting were consolidated. Between 1980 and 1984, all contracting was changed to "unit-price" basis, thus increasing the contractors accountability and easing the tasks to be performed by the administration. This gradual transition from force account to contracting has provided for a smooth process that has allowed the contracting industry to adapt progressively to increasing demands and has avoided major disruptions in public sector employment.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

The Ministry of Transport through its autonomous agency National Road Department, Departamento Nacional de Estradas de Rodagem (DNER) is responsible for the administration of the federal road network composed of 66,297 km of roads, of which 75% is paved (mostly asphalt concrete and surface dressings) and 25% is gravel or earth roads. The 26 states through their respective State Road Department, Departamento Estaduais de Estradas de Rodagem (DER), are responsible for the administration of 188,648 km of state roads (39% paved). Municipalities are responsible for the administration of about 1,250,000 km of roads in addition to urban streets. The 1989 budget for the federal road network (without debt service) amounted to about US$1,120 million, comprising US$395 million for new construction, US$404 million for maintenance, and US$321 million for personnel and other expenditures. The maintenance budget included US$298 million for rehabilitation, upgrading and periodic maintenance, and US$106 million for routine maintenance.

According to the ongoing reorganization, DNER is headed by a Director General supported by a National Road Council, an Administrative Council and a Deputy Director General. To assist in the administration, the Director General receives further support from a Secretariat for Planning and Road Development, a Road Research Institute, an Executive Group for Bid Evaluation, a General Counsel dealing with legal, contracting and appropriation matters and an Internal Audit Unit. DNER comprises four directorates: a) the Engineering and Works Directorate composed of the Projects and Environment Department, the Construction Department, the Improvements and Rehabilitations Department, and the Maintenance Department; b) the Road Operations Directorate composed of the Transport Department, Traffic
Department, and the Vehicle Weights Department; c) the Directorate for Technical Development; and d) the Directorate for Administration and Finances.

Maintenance Organization

The Central Maintenance comprises four divisions: Programs and Control, Costs and Production, Supervision and Technical Orientation, and Administrative Support. It defines policies, draws up technical specifications and does the overall financing, planning and monitoring of rehabilitation works and maintenance. The DRFs and their residencies are given flexibility in determining the needs of the roads under their responsibility, the programming of the services, supervision of quality and work measurement. The Central Administration monitors quality, productivity and costs through comparisons of physical production and expenditure at DRF level with established parameters and benchmarks, in addition to field visits.

Maintenance Planning

Overall maintenance planning is done in the Central Administration based on condition inventory of the federal roads carried out at 2-3 year intervals by the DNR field personnel and evaluated centrally. A sufficiency index in the range of "0" for good to "500" for extremely poor is used to assess surface condition evaluating 15% of the surface area. Each type of defect (cracking, raveling, rutting, bleeding, potholes, etc.) has a predetermined weight and its occurrence is quantified in sample areas at regular intervals along the highway. A 1989 survey of the national network indicated that 36% of paved roads was in good condition, 35% in fair, and 29% in poor condition. The corresponding figures for unpaved roads were 0%, 23% and 77% respectively. These results showed a deterioration from the 1986 figures (39%, 36% and 25% for paved, and 0%, 29% and 71% for unpaved roads).

Since 1975, Brazil has had extensive involvement in the research underlying the Bank's Highway Design and Maintenance Standards (HDM) Model; from 1979 to 1982 Brazil supported a comprehensive international research effort that resulted in the development of the HDM-III model. This model is used with the complementary "Expenditure Budgeting Model" (EBM) to analyze alternatives for network maintenance at given budget levels including the selection of rehabilitation projects. However, the use of these models did not entirely achieve implementation of a more balanced strategy between routine maintenance, periodic maintenance, and rehabilitation. Some reasons for this situation were: a) constant budget level fluctuations made pluriannual planning difficult; b) lack of continuity of high level staff in the Planning Directorate and weakness in the communications of that directorate with the executing directorates within DNER; c) financial and administrative constraints affecting quality and frequency of data collection and final presentation; and d) preference given to expensive rehabilitation projects preempting the use of scarce budgetary resources for maintenance. It is expected that the ongoing reorganization of DNER will address these issues and strengthen the use of the HDM model as a maintenance planning—budgeting tool.
Maintenance Budgets

In the last five years, maintenance budgets have been subjected, in real terms, to great variations because of: a) extensive and highly variable rates of inflation; b) frequent changes of policies on sources of funds for road maintenance; c) variable policies on total annual expenditures for the federal road network; and c) variations in the distribution of road expenditures between construction, rehabilitation and maintenance. It is estimated that a realistic annual budget should be in the order of US$450 million of which US$300 million should be spent for rehabilitation, strengthening and periodic maintenance, and US$150 million for routine maintenance.

The Maintenance Directorate distributes budget allocations throughout the network in accordance with the highway condition. For the distribution of the routine maintenance budget it has developed three cost standards for paved roads, according to traffic, and one for unpaved roads. These cost estimates are based on a weighted average formula covering traffic, topography, climate, and surface condition. The DRFs in turn are supposed to distribute the resources to the field residences in accordance with survey data on needs for each subsection based on priorities established for the following requirements, in decreasing order: a) for safety of users (patching, pavement, marking and signing); b) for protection and stability of the road platform (superficial drainage, culvert and ditch cleaning, correction of erosion); and c) for general appearance (road-side grass mowing and brush clearing, cleaning of road signs).

Execution of Road Maintenance

All periodic maintenance works are executed by unit price contracts. At present, three implementation modes are used for routine maintenance of federal roads: force account, delegation to the states and the army, and contract.

Force account by DNER's own personnel and equipment was used to perform all routine maintenance until 1970, and has been progressively reduced to reach a level of 12% of total routine maintenance expenditures in 1989. Efforts undertaken in the 1970s to increase efficiency of force account operations through introduction of a comprehensive Maintenance Management System (later downgraded in the northern regions to the use of two simplified forms), as well as the introduction in the 1980s of an Equipment Management System, failed to produce the expected results. The main reasons were the impossibility to hire the personnel needed to replace the retiring personnel, and administrative difficulties in the timely supply of fuel, materials and spare parts. The roads programmed to be maintained by force account, mainly unpaved roads in the north, have deteriorated rapidly in the last five years. It seems that all force account maintenance will cease over the next few years.

In 1971, DNER started a program to gradually hand over maintenance of federal roads to the DERs. The program was started with the transfer of maintenance of 2,250 km to four states and increased steadily, reaching in 1984 a total length of 22,700 km (32% of the federal network in that year), including about 5,000 km delegated to the army. Because of financial
difficulties, lack of firm political commitment, and discrepancies between DNER and the DERs on the extension of the network under their respective authority, on the application of the maintenance funds and on supervision procedures, the delegation program was reduced over five years until 1989 to a total of 16,240 km (about 25% of the network), including 3,464 km delegated to the army. Expenditures on delegated maintenance represented in 1989 about 26% of total expenditures for routine maintenance.

Contract maintenance undertaken by private contractors has been steadily increasing and represented in 1989 about 62% of total expenditures for routine maintenance.

III. CONTRACT MAINTENANCE

General

The contracting of routine maintenance by DNER began in 1970, with 18 contracts covering 1961 km of paved roads in six states, increased rapidly to 136 contracts covering 17,500 km in 1975, and reached 160 contracts covering 39,000 km in 1989. The average length of roads per contracts increased from 109 km to 244 km. The tendency is to include routine maintenance execution in the same contract with periodic maintenance and minor improvement works for a designated section of road facilitating contractor's programming and use of equipment.

Contract Provisions

Until 1980, DNER used mostly "cost plus contracts" whereby the contractor provided to DNER labor, equipment and materials against payment of the cost per man-hour, per equipment-hour and for materials plus a markup to cover profit and overhead. This system left DNER's field offices with the responsibility of organizing the use of these resources for the execution of the works.

Starting in 1979, these contracts were slowly replaced by "unit cost" contracts following a recommendation by the World Bank. By 1986, all contracts were based on unit prices. This change reduced the supervisory role of the DNER personnel allowing them to concentrate on the higher level management functions of planning, work identification, work inspection, quality control, measurement of works, and payments. It also increased the productivity of the contractors. To provide flexibility for execution of activities for which the unit costs cannot be reasonably predicted, the contracts may include up to 10% of the contract value to be done on a cost plus fixed fee basis. There is also a provision for the execution of emerging works at hourly rates, if requested by DNER.

The contracting of maintenance is regulated by the "Manual for Highway Maintenance" first published in 1974, coupled with the "DNER Price Table for Maintenance" first published in 1980 and updated every two years thereafter. The Manual codifies about 90 maintenance
activities and ranks them according to three priority categories based on average conditions. A "Quality Guideline and Performance Standard" is defined for each activity. It includes: task description, work procedures, recommended quantities of manpower, materials and equipment, as well as productivity data. These "Quality Guideline and Performance Standards" are used as bases for the price composition of the contract, and for quality control and acceptance of works by the inspectors.

Each DNER bidding document include two basic tables: the "Annual Work Plan and Budget" and the "Physical and Financial Progress Schedule." The former is the bill of quantities multiplied by the unit prices from the "Price Table," indexed up to the bidding date to cover inflation. Unit prices quoted by the contractor may exceed those published by DNER. However, the overall cost cannot exceed that included in the work plan prepared by DNER. Asphaltic materials and their transport are budgeted separately, the quantity is indicated, but the price is left blank and the contractor is reimbursed against the presentation of the purchase invoice plus a 15% markup. Hence, the bidders are not required to quote the cost of materials, the estimated value of which is added to the winning bid to complete the contract value. The Physical and Financial Progress Schedule indicates the proposed monthly distribution of work quantities as a percentage of the annual total. Expected monthly and accumulative amounts of billings are also included. The schedule initially prepared by DNER is adjusted before initiation of works to become the "Service Order" for the whole year, and may be revised periodically during the contract period considering the most appropriate or convenient time for the execution of the works, and the seasonal availability of labor. Emergency tasks, such as the removal of land slides and repairs of guardrails can be included as contingencies based on the probability of their occurrence.

The contracts are for a period of one year renewable up to a maximum of five years. At the end of the five-year period, new bids are called. Price escalation is computed monthly according to official indices set by the government for different types of works.

No mobilization advances are granted for maintenance contracts. However, contractors may rent DNER equipment, which has the additional advantage of bringing otherwise idle DNER equipment into productive use. This rental system is fading out as old equipment becomes obsolete and is not replaced.

Performance Bond, Guarantee, Retainage and Warranty Period

No bid guarantee is requested for maintenance contracts. However, awarded contractors are required to provide a performance guarantee equivalent to 1% of the contract price and further payment reductions are done during works execution to keep the total guarantee at 1% of the readjusted contract values. The retained amount can be replaced by a bank guarantee for the same amount. Both performance guarantee and retainage are returned to the contractors after a warranty period of 120 days. The request of performance guarantee has not represented a constraint for contractors.
Tendering of Contracts

Invitations by the DRFs for competitive bidding for contracts costing less than the equivalent of US$1.0 million, called "Price Quotations," are published 15 days before the deadline for proposals in local newspaper and some important national newspapers. DNRE publishes the invitations for competitive bidding for contracts costing more than the equivalent of US$1.0 million, 30 days before the deadline for proposals in important national newspapers. Contractors must meet the following criteria to bid for DNER maintenance projects: (a) have at least two years experience in maintenance work of no less than 100 km of paved roads; (b) own or be able to lease the equipment specified in the bidding documents; and (c) meet the legal and financial requirements specified in the bidding documents. The entire process from invitation to bidding to initiation of works takes place within a period of 8 weeks.

During the late 1980s, participation of contractors in bidding for maintenance works was rather low, in average three to four, and signs of collusion were detected. To attract more and bigger contractors and prevent collusion, DNER increased the size of maintenance contracts by including more pavement repair works. DNER also stipulated its own cost estimates as ceilings above which no bids are accepted. Both measures have increased competition dramatically. In recent (mid 1991) bids for some 30 maintenance contracts, an average of 25 bidders participated per bid.

In some isolated areas in the north or in the west of the country, contractors have shown little or no interest and DNER has been compelled to continue using force account or delegation to the states or the army.

Supervision

Supervision of contracts is carried out by DRF’s staff supported by consultants. It carries out the following tasks: (a) verification of the fulfillment of the physical targets of the Annual Work Plan and the Physical and Financial Progress Schedule; (b) verification of compliance with quality standards; (c) study and approval of location of borrow pits, quarries and delivery points for materials; and d) measurement of work done. DNER experience indicates that a staff of three inspectors can cover adequately the supervision and quality control requirements of 200 km of road provided the following conditions are met: (i) the supervisory team is qualified; (ii) the team is provided with adequate and timely transportation; and (iii) funds for per diem expenditures are readily available.

Payment Procedures and Audits

The contractors submit monthly estimates of quantities for payment, which are reviewed and approved by the corresponding supervising entity. Payments are made in average 6 weeks after presentation of bill, but there have been payment delays for more than three months. New legislation was introduced in 1990 allowing for payment of interest at commercial rates on bills overdue more than 30 days. Financial and quality audits are carried out.
Transition from Force Account to Contract Maintenance

The decision to use contract maintenance was taken by DNER in 1970 following government policy to reduce public administration employment and it was also geared to ensuring the additional capacity needed to satisfy expanding maintenance requirements triggered by the rapidly increasing traffic on the national road network. Conditionalities under the World Bank financed road loans contributed to the implementation of this decision. DNER's personnel has been reduced slowly by attrition over the years, from 27,500 in 1970 to 6,500 in 1991. The surplus equipment has been leased to contractors until its obsolescence and has not been replaced thereafter. Existing workshops and other real estate have not been reduced or disposed of.

To ensure the success in the steady increase of contracted maintenance, DNER has been taking over the years a number of coordinated actions.

a) Adaptation of the Maintenance Management System for force account operations to the planning and administration of contract maintenance;

b) Experimental introduction of a "cost plus" contracting system in the early years and their gradual transition to "unit price" contracting;

c) Development of detailed technical specifications and comprehensive bidding documents and work programming and control systems;

d) Actions from field and regional offices have been shifted from force account to contract administration;

e) In 1979, prior to the introduction of unit-price contracts in three pilot residencies, the district and residency engineers, inspectors and clerks were trained in: work planning, programming and budgeting, organizing and staffing, scheduling and work reporting. These training efforts were expanded throughout the DNER state offices and residencies, however, they were suspended in 1988; and

f) In addition to the initial training of DNER personnel, one day of orientation was provided to each of the key members of the initial contractors' staff. Later, DNER provided on-the-job management assistance to the contractors.

Assessment of Experience with Contract Maintenance

DNER's efforts to undertake comparative studies of the cost of performing specific maintenance operations by contract and by force account have not been conclusive, primarily because of the absence of comparable cost and performance data for government force account operations. The average cost per km per year for routine and emergency maintenance dropped
from US$6,500 equivalent in 1978 to about US$2,000 in 1989. In recent contracts, the average cost has increased to about US$9,000 per km per year because of the inclusion of much more pavement repair works.

DNER is satisfied with the results obtained in the efforts to expand contract maintenance, with the availability of contractors, and with the quality of work executed. Indeed, contracting maintenance has been fundamental to respond satisfactorily to the challenge of rapidly increasing maintenance demands.

Maintenance contracts are developed, tendered and awarded, and works execution is started within satisfactory time periods. The possibility of extending the one-year contracts up to five years has proven to be conducive to ensuring participation of capable and experienced construction firms, offered incentives for constant reliable execution of the contracts, and gave firms enough time for amortization of equipment.

Equipment availability has been no constraint because of the possibility of renting DNER equipment, and the fact that most equipment need for road maintenance is manufactured in Brazil and therefore readily available. Lack of replacement parts, repair facilities or skilled mechanics has been a constraint only in a few isolated areas.

DNER's supervisory capacity has been so far adequate, and has been supported by consultants, as needed.

IV. SUMMARY AND CONCLUSIONS

The DNER's experience over a period of 20 years shows that in the Brazilian context, contracting of periodic and routine maintenance is workable and efficacious; an expanding network of roads subject to increasing traffic has been maintained to reasonable standards, while the government has been able to reduce its establishment by 75%. Force account maintenance has diminished continuously and is in the process of fading out. Maintenance by delegation to the states reached a peak of 32% of total maintenance expenditures in 1984 and diminished to 25% in 1989. It remains a viable alternative, particularly with respect to maintenance of unpaved roads in the northern regions, delegated to the army.

An important advantage of contracting has been greater flexibility of resource dimensioning and balancing; contractors more easily gear up for peak demands, reduce when demand slackens, and change more quickly the mix of their resources to fit the changing nature of the work. These advantages were achieved gradually in the process from force account to "cost-plus," and finally to "unit price" contracted maintenance. DNER has succeeded in promoting the interest of the construction industry for a wider and more competitive participation.
The difference in cost-effectiveness, however, has been hard to quantify, primarily because of the absence of comparable cost and performance data for government force account operations. The average cost of maintenance of paved roads per km per year dropped from US$6,500 equivalent in 1978 to about US$ 2,000 in 1989.

Further increases of contract maintenance efficiency can be expected if DNER succeeds in securing more realistic and constant maintenance budgets thus allowing for more satisfactory programming of maintenance expenditures.
I. INTRODUCTION

In 1988, the Province of British Columbia Ministry of Transportation and Highways initiated a comprehensive program to privatize maintenance of roads and bridges. Under the program, responsibilities for management and performance of most maintenance activities within geographical areas were turned over to private firms under three-year, lump sum contracts. Twenty-eight such contracts currently underway amount to over 750 million Canadian dollars, and all these contracts will expire during 1991; the Ministry is in the process of letting contracts for the next three years. (An update on the situation is provided in Section V below.)

The initiative was enacted by the provincial government, on the premise that the work could be accomplished by the private sector at less cost while providing the same or an improved level of service. A desire to enhance the private construction contracting industry also played a role in the decision.

The Ministry has jurisdiction over about 46,000 two-lane equivalent kilometers of roadway. Gravel and earth surface roads account for slightly over half this total. About 850 two-lane equivalent kilometers is classified as freeway. This network includes over 2700 bridges. Prior to privatization, the Ministry maintained its roads and bridges by force account. The Ministry employed about 2700 people and sustained a fleet of equipment, along with storage and maintenance facilities, and supplies to perform road and bridge maintenance. Subsequent to privatization, almost all maintenance activities are performed by private firms. Most of the Ministry’s maintenance employees, equipment, and supplies have been transferred to the private sector.

II. MINISTRY OF TRANSPORTATION AND HIGHWAYS

General

The Ministry of Transportation and Highways is responsible for maintenance of all public roads in the Province, with the exception of roads in the City of Vancouver and local roads within organized municipalities. The Ministry’s annual maintenance budgets and expenditures have been in the range of 300 to 325 million Canadian dollars for the past several years (Note: 1 Canadian dollar = about 0.87 U.S. dollars). These budgets have remained relatively constant, even with the institution of the contract maintenance program. While most maintenance activities are now performed by private contractors, about 75 million Canadian dollars is spent annually for contract administration, supervision, and a relatively small amount of force account maintenance. However, this figure is expected to decrease substantially within the next few years, as competitiveness in tendering and cost-effectiveness of contract maintenance increases.
Maintenance Organization

The overall maintenance program is managed from the Victoria headquarters by the Chief Highway Engineer. However, the Ministry’s organization is decentralized. The operations section is divided into six regions (each headed by a regional manager, operations) and 26 districts (each headed by a district highways manager). The districts are subdivided into areas, each with an area manager who is responsible for maintenance monitoring.

Maintenance work throughout the Province is packaged into 28 contracts. In general, the contract work limits align with the district boundaries. Therefore, with two exceptions, each district is responsible for overseeing one maintenance contract.

III. CONTRACT MAINTENANCE

General

The lump sum contracts provide for all labor, equipment, and materials to perform routine and periodic maintenance of roads and bridges in specific geographic areas. The initial contracts, which were set in 1988, provide for 3 year contract periods. The second generation contracts will also use 3 year periods, but options will be included to extend them by an additional 2 years. Under the contracts, private firms manage and perform all maintenance of roads and bridges, including pavements and shoulders, roadsides, drainage features, signs and safety barriers, as well as snow and ice control and emergency response activities. In addition to these activities, the contractors are responsible for managing the maintenance and operations programs. In particular, they are responsible for identifying needs, setting priorities, and scheduling work. As part of this, the contractors are responsible for routine patrols, road and bridge inspections, and public relations.

Although the contracts are lump sum, they include estimated work quantities for some major periodic maintenance items, such as crack sealing, placement of gravel surface, placement of surface treatment, and installation of signs. Unit prices for these items are established during negotiations, and adjustments to the lump sum payments are made, based on actual work performed as compared to the estimated quantities. These unit price items constitute about 10 percent of the typical contract.

Pavement resurfacing as well as road and bridge rehabilitation and reconstruction are considered capital improvements. Accordingly, these activities are not included in the maintenance contracts. In addition, some specific maintenance activities, such as pavement markings, bridge deck overlays, and electrical items, including roadway lighting and traffic signals, are still performed by force account.
Contract Provisions

The contract requirements are defined in great detail in the standard contract documents. Nonetheless, many specific details of each contract are negotiated prior to execution.

The maintenance work to be performed is clearly defined by maintenance standards. These standards identify the reason for the maintenance activity and provide specifications, including materials and performance standards as well as construction methods (in general terms), and scheduling, including response times or deficiency thresholds. They are based on maintenance management standards that the Ministry used to convey work requirements to its forces prior to privatization. The performance standards vary, based on up to seven categories of roads (which are determined based on traffic volumes). In some cases, the performance standards refer to appropriate sections of the Ministry’s standard specifications for highway construction.

The maintenance standards do not prescribe specific methods to perform the work. Instead, the contractors are allowed to introduce new methods and technologies to improve productivity and efficiency. In fact, the emphasis on sound management, and incentives for quality and innovation, are strengths of the program.

While the performance standards describe the level of service that must be provided, the contractors are exposed to a relatively high risk in calculating the amount of inputs (labor, equipment, and materials) that may be required to satisfy them. The Ministry views this risk as a means of encouraging the contractors to manage their programs efficiently by performing preventative maintenance. Nonetheless, to limit the exposure, expenditure ceilings are established for some specific maintenance activities. As an example, the Ministry may absorb the cost over and above the established limits (per site) to replace deteriorated bridge bearings. Similar limits are established to control exposure to emergency damage (such as culvert or ditch wash-outs). These ceilings are established during contract negotiations.

Payment Provisions

Monthly payments are made to the contractors, based on a schedule that is agreed upon during negotiations. In some contracts, the payment schedule calls for additional money during the early stages of the contract period to provide for mobilization. In other contracts, additional money is paid during peak work periods, such as the winter months when extensive efforts are needed for snow and ice control. Still other contracts include increases during the later months of the contract period to provide for general increases in the cost of performing work due to eventual price escalation. Payments are made by electronic transfer on the first of each month.
Performance Bond, Guarantee, Retainage, and Warranty Provisions

The contractors are required to provide a $3 million performance bond (about 10% of contract value) as well as a $3 million labor and materials bond. However, there has been a concern about the effectiveness of performance bonds. Apparently, some bonding companies have interpreted "non-performance" as bankruptcy rather than unsatisfactory performance of work. The Ministry is continuing its efforts to resolve this issue.

Performance guarantees, payment retainage, or warranties on workmanship or materials are not required. However, the Ministry can cancel a contract in situations where the contractor fails to fulfill the requirements. Further, although warranties are not required, contractors must correct any deficiencies that may arise because they are responsible for ensuring that performance standards are met throughout the life of the contracts.

Tendering of Contracts

The tendering process used for the first series of maintenance contracts began with calls for initial proposals, which were solicited through public advertisements. The Ministry reviewed the initial proposals, and pre-qualified firms based on financial, operational, and management capabilities, previous applicable experiences, technical abilities, references, bank support, and bonding. Those deemed qualified were asked to submit detailed proposals. The detailed proposals were ranked based on management teams, operating plans, technical abilities, and to a slightly less extent, cost. These rankings were used as the basis for entering detailed negotiations to reach contract agreements.

However, as part of a comprehensive plan to ease the transition from force account to contract maintenance, the Ministry encouraged its employees to establish private firms and seek maintenance contracts. These so called "employee groups" were given preference in the contractor selection process. Eight such groups succeeded in obtaining a total of ten maintenance contracts.

Overall, the contracting industry demonstrated a reasonable amount of interest in contract maintenance. Over 75 firms submitted proposals for the initial series of contracts, some of them participated in the tendering of several contracts. Beyond the work obtained by the "employee groups," 12 private firms secured a total of 18 contracts. Most of these firms had previous experience with construction of roads and bridges. However, some were experienced in other fields, such as forestry or mining. Some companies from the Pacific Northwest region of the United States showed an interest in the program when the contracts were advertised, but none submitted proposals. All successful bidders were based in the Province.

In general, the Ministry is using a similar process to select contractors for the next generation of contracts. However, the "employee groups" will no longer receive special consideration. Also, an even greater emphasis is being placed on business and operations management plans.
The entire process, from solicitation for initial proposals through negotiation, execution, and mobilization and turnover, takes place within a period of about 130 days. The Ministry has devoted about a full year to preparation of bidding documents, including refinements to the performance standards reviewing all specific instructions according to the experience gained in the first three years of the program.

**Supervision**

The Ministry employs about 140 area managers, who are assigned direct responsibility for monitoring the contractor’s operations. Most manage work in geographical areas, but some oversee specific activities, such as bridge maintenance. At the district level, about 26 district highways managers and another 26 district technicians are involved with program management and monitoring. A total of 6 regional managers, operations, and 6 technicians are employed at the regional offices. Perhaps 50 person-years of administrative and support staff at the field level is directed to the maintenance program. Managers in the Victoria headquarters are involved with the program to some extent, as well. In total, the Ministry operates its maintenance program with about 250 employees.

As a significant part of the contract maintenance program the contractors are assigned primary responsibility for managing the maintenance and operation of the road network, including quality control of their work. Accordingly, the role of the Ministry staff is to ensure contract compliance and to provide general oversight of the contractors’ activities. They accomplish this by various means, including monitoring the contractors’ annual work plan, weekly and daily work schedule, observing conditions during travel, maintaining close communications with the contractors’ foremen, and performing quality assessment reviews.

The Ministry, with assistance from a consultant, developed a Quality Assurance (QA) program as a means of providing a uniform, objective method to appraise the contractors’ performance. The QA program is comprised of the following components:

- **Quality control**

  The contractors are responsible for quality of the work. Accordingly, they are encouraged to establish formal quality control procedures. The Ministry’s area managers are cautioned to recognize this important concept, but they are encouraged to foster close "team" relationships with the contractors and provide verbal assistance where appropriate. However, these communications are considered advice rather than instructions.

- **Quality Verification**

  The district and area managers verify quality, through the use of in-process inspections, end product inspections, and present state inspections.
In-process inspections are used to witness the performance of maintenance activities while the work is in progress to verify conditions that cannot be seen when the work is completed. The frequency of the inspections varies according to guidelines based on nature and scope of works.

End product inspections are undertaken when specific activities are complete. These inspections are only used to verify what can be observed after the work is completed. This technique is only used where inspection of the end product provides sufficient evidence that the work is acceptable.

Present state inspections are used to observe the condition of the network to ensure compliance with the performance standards. Each area manager performs monthly detailed assessments of 15 randomly selected 2-km segments of the road network. A weighted selection process is used to provide increased monitoring of the more heavily travelled roads. In addition, present state inspections are performed annually on each bridge.

The frequency of inspection, the form of reporting, and the procedures for following up are described in the "Inspection and Test Plan" of the QA program. A similar program is used to monitor quality of materials. Area managers devote an estimated 40 percent of their time to quality verification reviews. Documentation procedures are clearly outlined in the QA manual.

**Program audit**

Assessments are made by Headquarters staff (on about 6 month intervals) to ensure the QA program is being applied fairly and uniformly throughout the entire Province, and to verify that the QA program is effective.

Of the 28 contracts executed in 1988, one contractor was placed in default for unsatisfactory performance. In addition, several other firms, perhaps three, are performing at a less-than-desirable level. Overall, however, the Ministry is satisfied with the performance of the contractors.

**Transition from Force Account to Contract Maintenance**

Extensive planning was made to ensure a relatively smooth transition from force account to contract maintenance. The Ministry enacted a transition program that included the following noteworthy components:
Labor

- About 2600 maintenance employees throughout the Ministry were affected by privatization. During the transition, they were given the opportunity to remain with the government, accept employment with the contractors that obtained the maintenance contracts, or form "employee groups" and seek maintenance contracts. Those employees that elected to leave government service were able to withdraw their contributions to the retirement system. In addition, they received an equal amount that represented the government’s contribution.

- The contracts required the contractors to offer employment, providing the same position, salary, and union status, to all workers assigned to the territory included in the contract. In addition to accommodating the large surplus of employees, this ensured that a sufficient number of experienced people would be available to maintain the roads and bridges.

- As previously noted, the employees were encouraged to establish private firms and seek maintenance contracts. In addition to offering them special opportunities in obtaining contracts, the Ministry provided potential "employee groups" with training and assistance to improve their business skills. While some groups were unable to organize successfully, eight employee groups obtained a total of ten maintenance contracts.

- About 90 percent of the affected employees chose to work in the private sector. The remainder were placed in other government positions, retired, resigned, or were placed on long term disability. About five employees, all returning from disability, have yet to be placed.

- The employment options demonstrate the government’s deep concern for the well-being of its maintenance employees. Nonetheless, turmoil during the transition caused personal and family difficulties for many of these people, derived from job insecurity and resettlement anxieties.

Equipment

The contractors are required to lease Ministry maintenance equipment that has been in service for less than 7 years. In addition, the contractors are allowed to purchase the Ministry equipment when it becomes older than 7 years. Lease or purchase prices reflect market values.
Facilities

The contractors are also required to lease maintenance facilities, including equipment and material storage facilities as well as repair facilities.

Materials

The contractors are allowed to obtain materials from the Ministry, or from private sources. Materials from Ministry sources are purchased at market prices. Overall, disposal of materials was not considered a problem, though. The Ministry could use its supply of material, primarily natural gravel and crushed aggregate, on its road construction or reconstruction projects.

Administration and Supervision

As already noted, the Ministry undertook many actions to accommodate the realignment from an agency that performs physical maintenance to one that manages a program. Most notably, these include refinement of the maintenance standards, development of the QA program, reorganization of the field offices, and training of the remaining technical and administrative staff for their new supervisory functions.

Many other steps were taken to address concerns during the transition. For instance, in an effort to allow local contractors and suppliers to continue their involvement in maintenance work, the contractors are required to subcontract the same percentage of work that was formerly subcontracted by the Ministry.

The Ministry worked closely with employees at all levels, and with the union and the contracting industry, to develop and implement the transition. However, strong support from the provincial government may have been the element that had the greatest impact on the success of the transition.

Contractors’ Viewpoint

During the field reviews, we met with representatives of two firms that are performing maintenance for the Ministry. One firm -- Mainroad Contracting, Ltd. -- is an "employee group" which is owned by its employees. The firm is managed by a former Ministry district manager as well as an individual with extensive experience with heavy construction. The other firm -- Victoria Highway Maintenance Corporation -- is managed by an individual with extensive experience with highway and bridge construction as well as an individual that formerly held a management position in the Ministry.

They offered an insightful perspective of the Ministry’s contract maintenance program. Of particular interest, they raised the following points:
With very few exceptions, employees that transferred from the Ministry have successfully adjusted to private industry. One contractor noted that, after three years, only one individual was terminated and another two were downgraded to non-supervisory positions. Both firms noted they increased wages by at least 1 Canadian dollar per hour over the union agreement. The president of Mainroad Contracting, Ltd., indicated he believes employee ownership has been instrumental in their success. Representatives of the other firm noted improving motivation through other means, such as employee social gatherings and Christmas bonuses, and development of close relations between management and employees.

One firm indicated equipment leased from the Ministry was in acceptable condition, while the other company reported it was worse than they expected. Further, one firm noted a 3 year contract period is not sufficient to encourage the purchase of new equipment. However, the other firm mentioned they have purchased a large fleet of equipment.

The QA program, particularly the oversight and reporting, is viewed as wasteful and unnecessary, and contrary to the concept of "teamwork." Both firms voiced strong dissatisfaction with the Ministry's rating of contractors based on, among other items, subjective or indirect indicators.

While the maintenance section of the Ministry was downsized drastically during the transition, it may be somewhat overstaffed in light of its new role. If, in fact, this is found to be an issue, though, the Ministry may address it as it gains experience in managing the program.

The contractor's risk is too high. Specifically, the standards, while relatively specific and detailed, are still subjective, at least to a certain extent. Variances in interpretation or application of these standards by the Ministry can have a dramatic impact on the contractor's profit. This risk is increased in areas where the roads and bridges are more deteriorated. For the most part, differences are successfully worked out through conversations between the parties. The contractors are also concerned about excessive risk associated with emergency and major periodic maintenance.

Private industry can provide at least an equivalent level of service, for the same cost to the taxpayers, while making a reasonable profit. This profit is realized through more adoption of more efficient practices, particularly ones that concern the labor and equipment. They also use relatively innovative methods to increase their overall productivity. For instance, both firms noted they perform equipment repair and maintenance service for provincial and municipal government agencies as well as the public. Since they perform this work using facilities and mechanics obtained from the Ministry, their costs, over and above that expended to fulfill
their contract requirements, are minimal. Some contractors have been able to expand their activities obtaining additional maintenance contracts with urban municipalities.

- Both contractors mentioned they plan to submit proposals to renew the contracts for the zones they are currently maintaining. Moreover, both firms noted plan to seek contracts in other areas within the Province. This is a further demonstration of the contracting industry’s interest in contract maintenance.

- The experience in British Columbia has been successful because of mutual trust and a spirit of cooperation, along with a strong will to make the program a success.

Despite some misgivings on certain aspects of the program, the contractors expressed satisfaction with its development.

IV. SUMMARY AND CONCLUSIONS

In general, the condition of the network reveals that the Ministry has operated a very successful road and bridge maintenance program. In fact, the Ministry provides a relatively high level-of-service. This is particularly evident on the higher volume facilities. Everyone agrees that the contractors are providing at least the same level of service.

Further, the contract maintenance program appears to be performing satisfactorily. That is, the contractors seem to operate programs as effectively as typical government agencies. Indeed, they may be able to increase efficiency and productivity through means not normally available to the government. Accordingly, the contracting industry is able to perform the work for a reasonable profit. Indeed, contractors are interested in the work.

It appears the transition was relatively smooth. This is probably due, to a great extent, to the extensive planning performed by the Ministry. As a result of the planning, the Ministry implemented sound strategies to accommodate the surplus of equipment and facilities. In addition, the agency developed or refined many of its procedures to adjust to the change. The Ministry also worked closely with its employees, the union, and the contracting industry throughout the transition. Throughout, the Ministry showed a high regard for its employees during the transition. Unfortunately, the change was still very troublesome to many of them. Ultimately, clear support of the government may have had the greatest impact on the success of the transition.

The Province reports having obtained at least a moderate cost savings from the contract maintenance program. Indeed, the government expects these savings to increase as the Ministry and the contracting industry gains experience. However, without a thorough analysis, the savings are difficult to quantify.
V. UPDATED STATUS OF NEW CONTRACT AWARDING PROCESS

By mid-December 1991 the contract awarding process for the second generation of road maintenance contracts (1991-1994) had reached the following stage:

a) Twenty-five contracts had been signed, and had already started; one contract had been awarded and was ready for signature, and two contracts are being negotiated.

b) Of the 26 awarded contracts, 12 were won by the respective incumbent contractor and 14 were won by other bidders, three of which were won by two new bidders participating for the first time.

c) Participation was active with an average of three bidders per bid. One contractor won three contracts, six contractors won two each, and eleven contractors won only one each.

d) Of the former eight "employees associations," one won three contracts, two won two contracts each, and four won only one each. The last "employee association" was awarded a contract that is being negotiated.

e) The new contracts were awarded, on average, at a lower cost than originally estimated.
I. INTRODUCTION

Since 1982 Chile has increased the use of contract maintenance on its road network, reaching a level of 82% of total expenditures for road maintenance operations in 1990. Before the advent of the contract maintenance program, maintenance of the local roads (which constitute about 70% of all public roads), had been entrusted to municipal governments, which were unprepared for this task. The return of full responsibilities for the total network to the Ministry of Public Works was accompanied by a well-planned transition to contract maintenance transition. An effective pavement and maintenance assessment system, a planning and budgeting system, and an efficient cost-accounting system have been developed. Further actions to improve the effectiveness of contract maintenance are underway.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

The Ministry of Public Works (Ministerio de Obras Publicas, MOP) is responsible for maintenance of the road network comprising of 79,519 km, of which 3,570 km are paved with portland cement concrete, 5,381 with asphalt concrete and 2,050 with surface treatment, 32,400 km are gravel and 36,118 km are earth surfaced. The road network is functionally classified as: Basic Network (23,000 km, about 45% paved), Primary Local Network (24,500 km, largely unpaved) and Secondary Local Network (32,019 km, unpaved). The 1990 road budget, amounting to US$202 million equivalent, was distributed as follows: 31% for new construction and paving of gravel roads, 62% for maintenance and 7% for administration. Of the maintenance funds, 28% were spent for routine and 72% for periodic maintenance. The 1991 road budget increased by 25% and maintains a similar distribution.

MOP is divided into three general directorates: the Directorate General of Public Works, which is responsible for five infrastructure directorates and the planning directorate. The Directorate General for the METRO, and the Directorate General for Water Resources. The Road Directorate (Vialidad) is one of the five infrastructure directorates under Public Works. It comprises two main subdirectorates, one responsible for construction of main urban roads and the other for all other activities on the national road network. The latter subdirectorate includes separate departments for engineering, construction, bridges, maintenance, laboratory, operations, river training, and administration.
Maintenance Organization

The maintenance department provides overall management and direction of the maintenance program, focusing on policies, general planning and budgeting, technical issues, and general coordination of the program. It comprises three sections for planning, execution and equipment management. The planning section is responsible for general planning of maintenance at the national level, in close coordination with Vialidad's budget office and overall road planning Department. The execution section handles preparation, bidding and payments of all major periodic maintenance contracts, generally those above US$300,000 equivalent, and acts simultaneously as the Project Unit for the World Bank's Second Road Sector Project cofinanced by the Inter-American Development Bank and by the Eximbank of Japan. In the performance of these extensive responsibilities the execution section is assisted by a local consulting firm contracted for renewable two year periods. The equipment section handles equipment acquisition and oversees the regional equipment parks and repair of equipment.

The administration of the maintenance program at the local level and the specific administration of maintenance operations is the responsibility of Vialidad's regional offices in the 13 administrative regions of the country. They are responsible for establishing priorities at the regional level, to administer force account operations and to contract directly minor periodic maintenance works (generally under US$300,000 equivalent) and routine maintenance works. Vialidad's 13 regional offices each have an administration department, a maintenance department with equipment and workshops in charge of force account works, and a civil works contracts department in charge of contracting and supervising contracted work. The line of responsibilities extend through these departments further down to the provincial delegates (3 to 5 provinces for each region) and ultimately to the crew and contract supervision level.

Maintenance Planning

Overall maintenance planning is done centrally in Vialidad in the context of the annual review of a rolling four-year road investment and maintenance program through network analysis based on a reliable road condition inventory, comprehensive traffic data, and detailed road investment and maintenance cost and road user cost data. For this purpose Vialidad uses the Bank’s Highway Design and Maintenance Standards Model (HDM-III), complemented by a forecast of maintenance demands for the 3,570 km of portland cement concrete roads. The forecasted optimal level of expenditures is adjusted to expected budgetary resources using the Bank’s Expenditure Budgeting Model (EBM). This planning process establishes broad allocations for different types of civil works, namely: new construction, widening of roads from two to four lanes, paving of gravel roads, and periodic and routine maintenance of paved and unpaved roads. All investment and major periodic maintenance projects are evaluated and prioritized using the HDM-III model. Minor periodic and routine maintenance works are evaluated and prioritized at the regional office level.
Maintenance Budgeting

Within the framework of the rolling four year program, Vialidad prepares every year in April a detailed budget for the following fiscal year (January 1 to December 31) to be discussed with the Ministry of Finance and presented in August to Parliament for approval in October/November. The budget details specific allocations to all important works down to major periodic maintenance. The remainder is allotted in lump sums to each region according to the projected maintenance needs adjusted by specific regional requirements. Total road budgets remained rather constant, in real terms, from 1982 to 1990, however, the percentage allotted to maintenance has increased steadily during this period from 25% to 62% of the total road budget. This budget level is still far below the needs estimated through the HDM-III model. The 25% increase, in real terms, of the 1991 road budget and programmed annual increases by 10% over the next three years should bring maintenance expenditures close to optimal.

III. CONTRACT MAINTENANCE

General

The efforts to carry out maintenance by contract were initiated at the national level in 1982 for periodic and in 1987 for routine maintenance. They have been increasing steadily since. In 1990, 82% of all maintenance activities were carried out by contract (100% of periodic maintenance and 35% of routine maintenance). It is expected that the percentage of contracted routine maintenance will increase substantially in 1991 and thereafter as the workload increases and the government labor force decreases progressively by attrition. Vialidad keeps reliable and up-to-date records on contract and force account unit costs for maintenance operations averaged out by Regions, by geographical zones and nationwide. Force account unit costs are broken up in: labor, equipment (including depreciation), fuel, materials and overhead. Vialidad also keeps accurate records on physical quantities of a great number of maintenance items performed and monitors them against annual targets agreed with the Bank.

Contract Provisions

Road maintenance is contracted primarily through "unit price" contracts of 1 to 3 months duration for routine and 3 to 12 months for periodic maintenance. Hourly or daily rates for supply of equipment or personnel are sometimes included in routine maintenance contracts, and more often in contracts for execution of emergency works. The contracts cover either the execution of all maintenance activities on a specific road section or special activities at a specific location. Special contracts for supply of materials are used occasionally. Contracts are prepared using standard bidding documents and are based on technical specifications and acceptance criteria for materials. Technical specifications for maintenance are comparable to those for construction works. They are more detailed, accurate and stringent than instructions conveyed to force account maintenance crews. Bills of quantities are clearly defined and unit costs are
offered by the bidder. Flexibility is provided during contract execution to change, if necessary, some work quantities or to agree on unit costs for eventual new items. However, this provision is used prudently and in the last 4 years cost increases have averaged about 4% above initial estimates. Price escalation is considered only for contracts with more than a year duration. Mobilization advances of up to 20% may be requested by the contractor. Vialidad is considering the possibility to award multi-year maintenance contracts for the execution of all maintenance activities on all roads within specific geographical areas.

**Performance Bond, Guarantee, Retainage and Warranty Period**

The contractors are required to provide a performance guarantee equivalent to 5% of the contract price. In addition, 10% of each payment is retained until 5% of the total contract amount is reached. The retained amount can be replaced by a bank guarantee for the same amount. Both, performance guarantee and retainage, are returned to contractors after a warranty period of 12 months per periodic maintenance, and after completion of works for routine maintenance. The requirement of a performance guarantee represents a constrain for some smaller routine maintenance contractors.

**Tendering of Contracts**

Invitations for bids by headquarters are published in the main national newspapers and in the Official Legal Bulletin (Diano Oficial), while invitations by the regional offices are published in regional and in some national newspapers. For major periodic maintenance works contracts only contractors registered in the corresponding specialty and category of MOP’s Register of Contractors are allowed to participate. Participation in bidding for smaller contracts is permitted to contractors registered in MOP’s Register or in Regional Registers for minor contractors. Contracts are awarded to the bidder who presents the lowest evaluated bid, according to Bank guidelines.

Participation of contractors in bidding is satisfactory, on average 5 for periodic and 3 for routine maintenance, except in a few isolated areas, where contractors have shown little or no interest and Vialidad has been compelled to contract with the Army Corp of Engineers. The entire process from preparation of bids to initiation of works takes place within a period of about 12 weeks for routine, and 17 weeks for periodic maintenance. Contracting of emergency works requires a period of up to two weeks.

Overall, the construction industry has demonstrated a reasonable amount of interest in contract maintenance. The pool of contractors has been increasing annually by about 15%.

**Supervision**

Supervision of major maintenance contracts is carried out by consultants monitored by engineers of the maintenance execution section and of the coordination consulting firm. Supervision of minor contracts is carried out by engineers at regional or provincial level
supported by consultants and monitored centrally. The contractors are supposed to provide for quality assurance materials, which is monitored by Vialidad's laboratory personnel in the regions and at headquarters. In general, supervision of contracts is carried out by spot reviews to monitor quality of works and by monthly measurement of executed works.

**Payment Procedures and Audits**

The contractors submit monthly estimates of quantities for payment, which are reviewed by the corresponding supervising entity. Payments are made in average four days after presentation of bill. Financial and quality audits are carried out through spot checks by the Central Government Controllers Office, which prepares annual audit reports.

**Transition from Force Account to Contract Maintenance**

The decision to use contract maintenance was taken by MOP following government policy to reduce public administration employment and to implement the principle of the subsidiary role of the state. It also was geared to the need to increase its maintenance responsibilities from the Basic Road Network (23,000 km) to the total road network (79,000 km), reverting a government decision in the mid-1970s that had passed responsibility for maintenance of the Local Network (56,000 km.) to the municipalities without providing them with the adequate resources to carry out this task. In addition, this decision took into account the limitations of the force account staff and equipment to satisfy expanding maintenance requirements triggered by the rapidly increasing traffic on the Basic Road Network. The conditions of the World Bank financed road sector loans also contributed to this decision. No attempt was made at that time to evaluate comparative cost-effectiveness of contract versus force account maintenance.

The transition from force account to contract maintenance had been preceded by strongly enforced government policy in the 1970s to reduce public employment. Vialidad's personnel number was reduced at that time from about 11,000 to 4,500 by offering financial incentives for early retirement, including transfer of surplus equipment to former employees at affordable prices. Further reductions were achieved in subsequent years by attrition. Therefore, the increase of contracted maintenance in the late 1980s did not disrupt MPO's already limited personnel and equipment resources.

The equipment fleet has been progressively reduced and obsolete equipment is not being replaced, except for units needed to keep a minimum fleet, mainly for execution of gravel and earth roads maintenance. Existing workshops and other real estate has not been reduced or disposed of, although some of it is becoming redundant.

To ensure success in the steady increase in road maintenance by contract, Vialidad has taken a number of coordinated actions:
(a) Maintenance operations have been carefully planned, based on rolling four-year programs using the HDM-III and EBM models.

(b) Adequate financing of successive four-year programs has been ensured through agreements with the Ministry of Finance and international lending institutions.

(c) Availability of funds is ensured by continuous and timely allocations.

(d) Technical specifications for maintenance operations and adequate procedures for contracting have been developed.

(e) Actions of field and regional offices have been shifted from force account to contract administration.

(f) Supervision capacity has been substantially expanded by hiring of consultants.

(g) Establishment of training courses for maintenance staff on technical matters and on contract administration coupled with visits to other countries that have successful maintenance programs.

(h) Organization of meetings semi-annually for regional and maintenance engineers to discuss and exchange experience.

(i) Continuous information exchange with the construction industry and professional associations on development of maintenance programs and financing, and discussion of experiences obtained.

(j) Creation of special regional registers of small contractors to entice and regulate their participation and control their performance.

Assessment of Experience with Contract Maintenance

Vialidad has succeeded in developing a satisfactory cost accounting system and has established reliable unit costs for both contract and force account maintenance work items. The results seem to show that some maintenance operations are, in average, performed by force account as 40% lower costs than by contract. Although force account operations are in Chile far more efficient than in most developing countries, the comparison is not conclusive, because force account operations are not performed to the same stringent standards required for similar operations performed by contract.

Vialidad is satisfied with the results obtained so far in the efforts to expand contract maintenance, with the current availability of contractors, and with the quality of works executed.
Maintenance contracts are developed, tendered and awarded, and works execution is started within satisfactory time periods. Vialidad is considering to propose legislation to eliminate the requirement of performance guarantees from small contractors. Equipment availability has been no constraint because of the existing facilities for equipment leasing by private companies. Lack of replacement parts, repair facilities or skilled mechanics has been a constraint only in a few isolated areas.

Occasional problems resulting from defective bid documentation or inaccurate cost estimates have been solved expeditiously by the supervision. Isolated cases of inexperienced contractors have been overcome through assistance by the supervision teams during work execution. Only a few contracts have been canceled.

Private consultants in supervisory roles have provided human and material resources needed to complement scarce in-house resources and have performed effectively. However, effectiveness of the consultants has been sometimes constrained by insufficient availability of vehicles and office equipment.

The contractors interviewed showed satisfaction with the existing arrangements and demonstrated a keen interest to continue participating in the contract maintenance program. Bigger contractors expressed interest in the development of multi-year maintenance contracts that would allow acquisition of specialized equipment. They also expressed their willingness to take over contracts for execution of all maintenance activities of the road network in specific provinces or areas.

IV. SUMMARY AND CONCLUSIONS

The condition of the basic road network reveals that Vialidad has been more successful than most road agencies in developing countries to operate an adequate road and bridge maintenance program, although the achieved standard is still below the standard in most developed countries. Maintenance of the local network, particularly of secondary local roads, is clearly insufficient. The past inadequacy of the road maintenance budget is being progressively overcome. The destructive impact of excessive axle loads on the pavements of main roads has been completely eliminated in the main roads through adequate control; positive actions to extend this control to other roads, as needed, is underway.

Vialidad has developed a highly satisfactory and efficient pavement and maintenance assessment, planning and budgeting system. This system, coupled with preparation of rolling four years programs for road investments and expenditures programs, have assured continuous and increasing financing of the maintenance program both from government and international lending agencies.

Vialidad also has succeeded in developing an accurate cost accounting system and has established reliable unit costs for both contract and force account maintenance work items. The
results seem to show that some maintenance operations are performed by force account at 40% lower costs, in average, than by contract. Although force account operations are in Chile far more cost-effective than in most developing countries, the comparison is not conclusive because force account operations are not performed to the same stringent standards requested for similar operations performed by contract.

A special effort should be developed to use the existing cost accounting systems to permit more realistic cost comparisons between contract maintenance operations, and force account operations complying with the same stringent specifications and quality standards.

In contracting maintenance Vialidad has relied so far only on short-term unit price contracts based on predetermined bill of quantities for execution of selected maintenance operations on specific roads. To entice more active contractor participation and to allow contractors to acquire specialized equipment and capitalize more effectively, Vialidad should pursue the development of multi-year contracts including all road maintenance activities on the road network of specific areas.

To a large extent, the transition from force account to contract maintenance has been successful because of adequate planning of all necessary measures and actions, stability and preparation of agency staff, and positive participation of consultants and contractors.
I. INTRODUCTION

Private contractors have always had some involvement in road maintenance. Indeed, most resurfacing, rehabilitation, and reconstruction has been performed by the private sector. The Local Government Planning and Land Act of 1980 was enacted to, among other items, require competitive tendering of most highway maintenance activities. The goal of the legislation was to create cost savings through private sector competition or through increased efficiency, productivity, and competitiveness of the force account units. Unfortunately, only limited information is available concerning the impacts of the legislation. However, it appears the legislation has led to some positive changes.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

In the United Kingdom there are different transport authorities for England, for Scotland, and for Wales. This report deals with the road sector in England. The Department of Transport (DTP) is responsible for maintenance of the national network. This system consists of about 2640 km of motorway and about 8185 km of other trunk roads. All other public roads (approximately 260,000 km) throughout the country are maintained by local authorities. Maintenance works are divided into capital maintenance and current maintenance. Capital maintenance covers major works, the execution of which can be carried forward from one financial year to the next year. Current maintenance covers minor works executed within a financial year. The budget for the national road network for the present financial year (April 1, 1991 - March 31, 1992) amounts to £1,884 million (£1 = about US$1.75) and includes £1,326 million for new construction and improvement, £303 million for capital road maintenance, £122 million for capital bridge maintenance, and £133 million for current maintenance. This last category entails routine and winter maintenance, as well as small scale rehabilitation or reconstruction activities. Capital maintenance expenditures have increased 124%, and current maintenance expenditures 30% over the 1988-1989 level. Further annual increases of about 3% and 2%, respectively, are planned for the years 1992-1993 and 1993-1994.

Maintenance Organization

The DTP is headed by the Secretary of State for Transport. The organization consists of Headquarters and 9 Regional Offices. The Regional Offices work closely with a total of 90 local authorities that actually perform or directly supervise maintenance works on behalf of the DTP.
The role of the Headquarters Office is to provide overall management and direction of the maintenance program. It focuses on policy, budget, and technical issues at the national level. The Headquarters has only limited involvement with maintenance works at the project level.

The regional offices are responsible for detailed managing the road maintenance program working closely with the local authorities. They are responsible for establishing priorities at the regional level and approving and overseeing major maintenance contracts to accomplish the needed work. They are also responsible for overseeing maintenance of national roads by the local authorities.

The regional offices are generally separated into two sections -- new construction and network management. Each section is headed by a director. However, in two regions where the new construction programs are relatively small, the sections are combined. The network management sections of the regional offices are typically divided into areas (which may consist of 1 or 2 counties), each headed by an engineer.

The local road authorities (or local agencies) are administratively associated with the DTp through the respective regional office, and perform or supervise most maintenance activities on the national network. There are 90 such authorities, which include county councils, metropolitan district councils (primarily larger cities), and London borough councils (local government authorities in the greater London area). In recent years road authorities of some countries and some London burroughs have been replaced by consulting enterprises. The specific role of each local authority is defined in "agency agreements."

The units within local authorities that perform force account maintenance are referred to as "Direct Labor Organizations" (DLOs). Such DLOs exist not only at the county level, they may exist also at the level of the metropolitan districts or of the rural districts in which counties are usually subdivided. There appears to be a widely held position that snow and ice control is too critical an operation to be assigned to non-government entities. Therefore, the size of the DLOs is often determined by winter maintenance needs.

The consulting engineers are unique among the collection of local authorities. These firms are under contract with the DTp to provide the maintenance and operations services on national roads instead of local councils. The use of consulting engineers began on a very limited basis in 1986. At that time, local councils were reorganized in many of the larger urban areas. Rather than assign maintenance responsibilities to all the newly created entities, the DTp elected to assign the work to consultants. During recent years the Ministry has made much greater use of this practice. It has been expanded to the point where consulting engineers manage maintenance in about one third of the London Borough Councils and in some rural counties. For the most part, consulting engineers have been used in administrative subdivisions that have relatively small networks of national roads.
The DTP uses its standard consultant selection process (which consists of a technical evaluation, followed by price negotiation with the firm deemed most qualified) to obtain the services. The consulting engineers perform most contract development and administrative activities. However, for legal reasons, they cannot tender contracts or enter into contracts with private contractors to perform maintenance works. Therefore, these functions are performed by the regional offices. Similar to other local authorities, the consulting engineers perform direct supervision of maintenance contracts.

Local road authorities, including those that have been replaced by consultants in their responsibility for the maintenance of national roads, continue to be responsible for the maintenance of local roads.

Maintenance Planning

The Headquarters, regional offices, and local authorities play a role in maintenance planning. Information about pavement condition and strength as well as skid resistance are collected every 3 years by in-house personnel of the road authorities or by consultants. This frequency may be expanded to 5 years as greater use is made of automated survey equipment. All this information is used by the Headquarters in long-term planning.

The Ministry is also working to improve its use of management systems. A large database on road and bridge condition is maintained. A pavement management system is being developed, and a system similar to a bridge management system is being considered. In fact, they hope to incorporate all relevant information into a comprehensive maintenance planning system.

Short-term planning and scheduling is performed by the local authorities. These authorities are required to perform "safety inspections" on a frequency of weekly or monthly, depending on the class of national road. The purpose of these inspections is to identify defects likely to create a danger or serious inconvenience to the motorists. The local authorities are also required to perform "detailed inspections." These inspections are performed at various intervals (generally between 6 and 12 months) to identify routine maintenance needs that are not urgent. The High Speed Road Monitor (HRM) is used on a routine basis to monitor texture and profile. Specific values that trigger the need for routine maintenance are provided in a maintenance manual entitled Code of Practice for Routine Maintenance. They are used in conjunction with the Routine Maintenance Management System (RMMS), a computerized relational database, to assemble the information from inspection into maintenance programs and to produce work orders. Accordingly, information gathered from detailed inspections contributes to short, medium, and long-term planning.

The regional offices are responsible for overseeing the management of the maintenance programs. As part of this role, they must monitor and approve short-term priorities identified by the local authorities. The regional offices are, in fact, responsible for directing the maintenance activities to be performed.
The DTp is also in the midst of a 15 year structure rehabilitation program. The program was initiated in 1987 to upgrade all bridges on the National network to current standards. The program includes three categories: steady state maintenance, strengthening, and upgrading. Steady state maintenance includes activities such as repainting, waterproofing, and concrete repairs to slow deterioration and keep structures in good condition. Strengthening involves upgrading the bridges to meet increased loads that will be allowed by European Community standards. Upgrading is intended to rectify portions of structures that do not meet current design standards. This program will address items such as substandard parapets, inadequate deck waterproofing, and corrosion of reinforcing tendons in post-tensioned bridges.

Maintenance Budgeting

Maintenance needs are identified by the local authorities. Relevant information to describe and support the proposed works is forwarded to the regional office. The regional offices, in turn, determine region-wide priorities. Work is classified as either a minor or major scheme, depending on whether the estimated costs exceeds £500,000.

For major schemes, the local authorities must propose projects to the regional offices by March 31 for funding during the next fiscal year (which would begin April 1 of the following year). The regional offices assess the proposals and add any information they may have concerning either the needs or the technical approach of each proposal. They then forward the information to the Headquarters. There, the Highways Maintenance Division determines whether the proposals are acceptable, based on cost and technical considerations. Decisions are forwarded to the regional offices, usually in August or September.

The regional offices hold primary responsibility for advancing minor schemes. The Headquarters office involvement is minimal.

The DTp submits an annual budget request for maintenance of the national network to the Treasury. The budget is based on needs and priorities identified by the regional offices combined with planning information concerning condition, projected deterioration (long-term needs) and traffic. The Treasury approves or modifies the proposed budget to accommodate availability of funds and other national priorities. The final budget must ultimately be approved by Parliament.

As the budget approaches final approval (usually about November), the Headquarters develops broad priorities and a plan to distribute the funds among the regional offices. Issues such as geographical distribution of work, ability of regional office or local authority to manage workload are considered. Upon approval of the budget, allocation is then made based on this plan (usually in December or January).

The regional offices are free to select priorities after they receive their budget allocations. They consider their initial region-wide work proposal, recommendations from the Headquarters, and changes in condition and local needs. However, the regional offices cannot initiate large
capital maintenance schemes that were not approved by the Highways Maintenance Division of the Headquarters.

Five percent of the value of capital maintenance contracts can be carried forward from one budget year to succeeding ones. No current maintenance funds can be carried over. This presents a major constraint to maintenance planners. Often, small maintenance projects that can be completed quickly are tendered near the completion of the fiscal year to expend funds that would otherwise lapse.

III. CONTRACT MAINTENANCE

General

Prior to the 1980s, most routine maintenance and some periodic maintenance was performed primarily by the DLOs. In fact, most capital maintenance projects have traditionally been undertaken by private contractors. However, the Local Government Planning and Land Act of 1980 (as amended in 1983 and 1987), commonly referred to as the Local Government (Direct Labor Organizations) legislation, had a significant impact on the process used to select the appropriate method to perform road maintenance. It introduced bonus incentive schemes to increase the productivity of local authority labor forces and streamlined their organization to further increase their effectiveness. It also established the use of productivity data for estimating costs and tendering in competition.

The legislation, which took effect in England in April 1981, requires competitive tendering of, among other items, many highway construction and maintenance activities. The goal of the legislation was to create cost savings through private sector competition or through increased efficiency, productivity, and competitiveness of the DLOs. The original regulations of the 1980 Act stipulated that for highways work, no job above £100,000 could be awarded as-of-right to the DLO. This was then amended in 1982 and 1983 to reduce the threshold to £50,000 and to allow authorities to award to DLO as-of-right no more than 70% of the total value of work below this threshold done in the previous year by DLO or contractors. Subsequent amendments reduced the threshold further to £25,000 (from April 1987) and the maximum percentage below this that can be awarded as-of-right was decreased to 40% (from April 1988). In addition, winter maintenance, emergency work and certain extension jobs can be awarded without competition.

The legislation contains many intricacies. For instance, local authorities can consider the redundancy costs when comparing DLO and private sector bids. That is, they can consider the cost of labor and equipment that would be idled if maintenance work is performed by contract. However, the legislation only allows each DLO to use this exemption once. As another example, local agencies are allowed to consider the cost of supervision when evaluating bids from private contractors.
Capital road maintenance is contracted primarily through "unit price" contracts. "Lump sum" and "hourly reimbursement for equipment or personnel" contracts are rarely used, and only on an experimental basis or for unusual projects. Current, or routine, maintenance is also contracted primarily with the use of "unit price" contracts. However, minor, miscellaneous work is often performed by "cost-plus-fixed-fee" contracts.

Winter maintenance for the motorways is handled somewhat differently than most other maintenance activities. The DTp owns a fleet of specialized winter maintenance equipment, including plows and spreaders, as well as equipment storage facilities. In addition, the DTp owns a reserve fleet of vehicles, including 23 snowblowers, which can be deployed throughout the country as needed. Winter maintenance efforts are managed by ten field managers located throughout the country. As with other maintenance activities, the local authorities operate the equipment on behalf of the DTp. Overall, the work is performed by the DLOs, but contractors manpower is being used by the local authorities to an increasing extent. This is to facilitate more flexible planning to meet the very unpredictable nature of English winters. The local authorities are reimbursed directly for their costs. If excess capacity is available, the local agencies can request approval to use the equipment on other types of roads. However, there is a charge for such use.

Contract Provisions

Both maintenance and construction contracts are based on a national Specifications for Highway Works. This can be somewhat cumbersome, though, for smaller contracts.

The Code of Practice for Routine Maintenance provides specific trigger values for when routine maintenance work is to be performed. For instance, potholes are to be patched before they reach depths of 25 mm. Both local authorities and contractors that are responsible for all maintenance activities on specific sections of road are required to meet the requirements provided in the Code of Practice for Routine Maintenance. However, concerns have been voiced that the maintenance budgets are not always sufficient to allow full compliance with the performance standards.

The maintenance standards do not prescribe specific methods to perform the work. Instead, the contractors are allowed to introduce new methods and technologies to improve productivity and efficiency.

Performance Bond, Guarantee, Retainage, and Warranty Provisions

Contractors are required to provide a performance guarantee (often by a parent company) or a specific 12-1/2 percent guarantee. Five percent of each monthly payment, up to a limit of three percent of the contract value (as bid), is retained. Half the retainage is returned when the work is completed, the remainder following the warrantee period. Performance bonds are only used in limited cases.

Contractors must also warrantee the workmanship and materials for one year.
Tendering of Contracts

In general, maintenance contracts are solicited through open competition. In fact, projects over £25,000 must be tendered. The procedures used to tender contracts varies in accordance with the size of the projects.

The Headquarters manages the tendering of larger projects (over £1 million). The process is as follows:

- Initially, a prior notice must be published in public journals to announce upcoming contracts and to describe the procedures that interested firms must follow to register. These prior notices are also published in the European Community journal, as well. Often up to 40 firms respond to the prior notice, though between 10 and 15 contractors typically demonstrate an interest in maintenance contracts. Registration is based on experience, quality of work, and financial capabilities. Performance data is maintained for each contract (including a rating by the contract agency’s project engineer) to document prior experience and quality of work.

- From this group, the Headquarters (in consultation with the appropriate regional office) selects from 10 to 12 firms that are considered most qualified.

- As the contracts are readied for tendering, the Headquarters queries the selected firms of their continued interest in the work. This step may take place several months after the initial notice is issued. Usually all firms respond positively.

- The Headquarters then selects about 6 contractors and places them on a tender list. The tender list is developed using a formal process (records are maintained to document the decision-making process).

- The regional offices are responsible for tendering and awarding contracts. The appropriate regional office asks the firms on the tender list to submit bids. Award is conventionally on the basis of lowest price, although with "lane rental" type contracts, traffic delay costs are also taken into account. This lane rental award criteria has proven to be highly effective in motivating contractors to increase their rate of output.

Smaller contracts (less than £1 million) are managed by the regional offices. Contracts may be advertised, based on local policy. As an alternative, regional offices can directly invite qualified contractors that may be interested. As with those interested in larger maintenance contracts, firms are registered based on experience, quality of work, and financial capabilities. Under "agency agreements" local authorities may be the contracting agencies. However, these agencies must follow tender and contract administration procedures identified in the agreements. Monitoring and oversight is performed by the regional offices.
The entire process, from the contractors' preparation of bids through start of work, typically takes 3 months.

The contracting industry has demonstrated an interest in contract maintenance. There are no institutional problems. Bidding procedures, bonding or warranty requirements do not constrain the success of the contract maintenance program. There is a sufficient supply of skilled labor, equipment, and materials.

However, budget fluctuations have had impacts on the level of maintenance work performed by tender.

Payment Procedures and Auditing

The contractors submit monthly estimates of quantities for payment. These estimates are reviewed by the contracting agency and compared with notes and quantities recorded by the inspectors. Payment typically is made within 28 days.

Audits are performed by the Internal Audits Division of the Transport Ministry.

Assessment of Experience with Contract Maintenance

Only limited information is available to document the impacts of the legislation, and specifically, changes in the amount of maintenance work performed by contract. The following table summarizes the number of DLOs nationwide:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of DLOs</th>
<th>% of Authorities that have DLOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982/83</td>
<td>265</td>
<td>75</td>
</tr>
<tr>
<td>1983/84</td>
<td>268</td>
<td>81</td>
</tr>
<tr>
<td>1984/85</td>
<td>280</td>
<td>80</td>
</tr>
<tr>
<td>1985/86</td>
<td>290</td>
<td>86</td>
</tr>
<tr>
<td>1986/87</td>
<td>292</td>
<td>87</td>
</tr>
<tr>
<td>1987/88</td>
<td>280</td>
<td>84</td>
</tr>
</tbody>
</table>

Some of the increases reflect changes in accounting methods. Overall, the number of DLOs has remained quite steady.

Less than half a dozen have become fully commercial, independent private companies, though many are considering such a route. At least one DLO has gone bankrupt, and another has been closed for consistently failing to meet targets.

The Audit Commission for Local Authorities and the National Health Service in England and Wales released in July 1991 a study on the impact of competitive tendering on Highway
maintenance, undertaken in consultation with the local government associations and the Department of Transport. The study reviewed in depth a sample of 13 authorities ranging in type, size and geographical location, covering the period 1986 - 1990.

The study concluded that increased competition in highway maintenance has created savings worth approximately £25 million a year without deterioration in the quality of work. It found that on average, authorities have saved 15% on the work newly exposed to competition, representing a saving of 4% on their total highways maintenance expenditures. Individual authorities have experienced reductions of up to 29%. Most authorities felt there had been no loss in quality of work and that work planning had improved.

Another conclusion of the study was that changes to the competition regulations have not led to large increases in staff to cope with any additional administration or supervision. Contractors prices have tended to follow inflation and much of the savings to authorities is due to increased efficiency in the DLOs, resulting in lower prices charged by them. The DLOs have lost a little of their market share, but continue to compete for most types of work.

Most authorities questioned believed that the changes in the competition regulations have had a neutral or slightly beneficial effect overall. However, many authorities argue for the retention of a competition-free allowance to enable their direct labor organization to continue to operate with some work not won competitively. Not all are convinced of the ability of the private sector to provide support for emergencies and winter maintenance.

Howard Davies, Controller of the Audit Commission said "This study has shown that in the case of highways maintenance, there have been both financial and quality benefits from competition. It is also pleasing to see DLOs competing well, and reducing their prices by increasing their efficiency. Authorities should now review their practices to see whether there are further benefits to be achieved."

Experience in Hampshire County

Hampshire County is a local authority that has retained its DLO. However, the county has taken some significant steps to improve productivity and efficiency. Thirty years ago the county employed about 1100 people for road maintenance. This staff was gradually reduced with an increased use of mechanization. In 1984 the number of maintenance workers totaled about 400. This figure was reduced to about 330 with the introduction of an early retirement program. Productivity was increased, though, with a bonus scheme that was introduced in 1983. The County Surveyor noted the DLO may be able to operate effectively with a staffing level of between 200 and 220. This change could be implemented by reducing the number of workers assigned to each truck during winter maintenance operations from two to one.

The County Surveyor also mentioned that the DLOs must obtain about one third of the maintenance work performed by tender to keep their work forces active during the non-winter period. Some DLOs in Hampshire County have expanded their work into other markets,
including supplying materials or performing road construction and maintenance activities for the private sector, other districts, or other counties.

The County Surveyor noted the availability of DLOs provide the local authorities with increased flexibility in managing the program. Further, DLOs may ensure competition and serve to control the prices for maintenance work. Accordingly, Hampshire County owns an asphalt plant as well as paving equipment. As with many other local authorities, the size of the DLOs is controlled by winter maintenance needs. The County Surveyor indicated the DLOs should have the ability to perform all snow and ice control during the first 24 hours of a winter event. Additional work, including clean-up, are activities that are suitable to be performed by contract.

The County Surveyor also stressed the that the DLO work force has a tremendous loyalty to public service. That is, the DLOs are more committed to the needs of the public than contractors, who are primarily concerned with profit. This loyalty is being lost as the emphasis is being shifted to cost.

The county expends about £15 million on road maintenance. Approximately £3 million is performed by the DLO without tendering. This consists of miscellaneous, small, isolated works packaged in amounts not more than £25,000. The remainder of the budget, which is performed by tendering, is expended as follows:

- General specific maintenance (£2 million): This type of contract is based on a theoretical list of quantities for about 100 work items. Between 12 and 15 firms, including the DLOs, are invited to offer unit prices. For each area of the county (Hampshire County is divided into three areas) the six lowest offers are selected. When a specific maintenance scheme is prepared, the total cost is calculated using the estimated quantities for the work, along with the unit prices of the six selected firms. The work is awarded to the firm with the resulting lowest cost. Typically, small quantities of work (£30,000) are packaged.

  County DLOs were selected in all three areas. In addition, two district DLOs were selected in their respective areas. Accordingly, some general specific maintenance work is performed by force account while a portion is performed by contract.

- Street light maintenance (£2 million): This work is included in 3 large contracts of which the DLOs have not shown an interest. Traditionally, this work is performed by private utilities.

- Surface dressing (£2 million): This work is tendered for six areas. For main roads a 3 year contract (including unit prices and adjustments for inflation) is used. Seven firms, including the DLO, offered bids. Award was made to a private firm for £220,000 per year (total £660,000). The remainder of surface
dressing work is performed by separate bids for the supply of bitumen and processing. In early 1980, the DLOs had a virtual monopoly on these contracts. Now about 75 percent of this work is performed by contract.

- Specific contracts (£6 million): This type of contract is used to perform resurfacing and reconstruction work. Award is made to the lowest bidder, using conventional unit price contracts.

The County Surveyor discussed some positive changes that have resulted from the increased use of contracting. For instance, the overall administration of the maintenance program has improved drastically because contracts must be developed for most major works, including the work obtained by the DLOs. Accordingly, the work is much more clearly defined. In addition, the level of supervision has increased. This has been accommodated with a gradual shift of staff from maintenance worker to technician or engineer. The level of supervision may be decreased in time as the contractors adopt quality assurance programs.

Experience in the Leeds Region

In the vicinity of Leeds, maintenance of motorways is managed by consultant engineers (maintenance for non-motorway trunk roads is performed by the DLOs). Separate firms are performing the role in two counties. In fact, these two, along with another firm, manage all six consultant engineer areas nationwide. The contracts extend for five years, and both are nearing the end of the contract period. The consultants were selected based on qualifications, using the standard consultant selection process.

The firms are responsible for preparing the maintenance contract documents and analyzing the bids. They direct the work, including identify specific needs and coordinate scheduling, and monitor the work.

The maintenance work for all motorways was packaged into separate contracts for each county. As it turned out, one contractor obtained both contracts. The contractor is currently in the first of a 3 year contract period. The first time the work was contracted, the contract period was 1 year with allowance for a 6 month extension. The second contract extended for 2 years. The contractor indicated 5 years would be preferable to encourage greater investment in equipment, particularly expensive, specialized pieces.

The maintenance contract provides for payment based on unit prices. In fact, the contracts include about 2000 items. Sometimes, separate items are provided to account for amount of work to be performed. For instance, the cost to repair one pothole may be different (probably less) than the cost to repair 10 potholes. For small, miscellaneous activities, payment is based on a cost-plus schedule (standard labor, equipment, and material rates, multiplied by a percentage charge offered in the bid). Annual adjustments are used to account for inflation.

The contractor has developed a separate organization to focus on routine and periodic maintenance contracts. In addition, the company has a division that concentrates on capital
maintenance (rehabilitation, and reconstruction) projects. A third group performs minor works, including construction or maintenance of local roads and private facilities.

Contractors' Viewpoint

The mission met with officials of the Federation of Civil Engineering Contractors. Representatives of several contractors that are members of the Federation also attended. In addition, we met with a contractor that is performing maintenance of the motorways in two counties in the vicinity of Leeds. The following noteworthy points were raised during the gatherings:

- The contractors can perform road maintenance, including planning and operations, at a reasonable cost while making a profit.
- Most contractors, especially the larger ones, have little interest in the small maintenance works (less than £25,000) that are currently exempt from competition.
- Contractors' employees also develop a deep loyalty to the public. In fact, loyalty and quality are important ingredients of profit.
- Private contractors have always had some involvement in road maintenance. Indeed, most resurfacing, rehabilitation, and reconstruction has been performed by the private sector. Since the privatization legislation, the contractors have received a slowly but relatively steadily increasing amount of maintenance work. However, the shift from public to the private sector has not been as dramatic as expected.
- Many DLOs have become much more efficient.
- Development of good working relationships between the local agencies and the contractors is important to the success of contract maintenance.
- There is a general concern about the DLOs expanding outside their traditional roles.
- The contractors have a strong desire for fair competition, but they highlighted the following aspects that may provide advantages to the DLOs:

  - In essence, the local road authorities play the role of both contracting agency and contractor. Therefore, the DLOs can package contracts for tender that favor the DLOs. For example, miscellaneous, unrelated work activities that the DLOs are equipped to perform may be combined into a contract that is not attractive to the private sector. In addition, method specifications
may be used that serve to discourage the use of more efficient techniques.

The application of specifications and work requirements is not uniform. Overall, the DLOs are particularly weak in fulfilling work zone traffic control requirements.

The accounting methods used by the DLOs may provide advantages to the public sector. For instance, financing (the cost of borrowing money to purchase equipment, materials, and supplies) may not be properly considered. In addition, the contractors are paid between one and two months after the work (or a portion) is completed, while the DLOs receive payment on a quarterly basis, in advance, for work planned to be performed by force account. There is little third party monitoring or oversight of the local agency agreements.

The local authorities are allowed to add the costs, such as supervision and redundancy, to contractors' bids.

IV. SUMMARY AND CONCLUSIONS

The Local Government Planning and Land Act of 1980, which took effect in England in April 1981, requires competitive tendering of, among other items, most highway maintenance activities. Since the privatization legislation, the contractors have received a slowly but relatively steadily increasing amount of maintenance work. The shift from public to the private sector has perhaps been less dramatic than expected. In fact, the number of force account units (DLOs) has remained steady and there is a general impression that in bidding for works DLOs enjoy some advantages over private contractors. However, the following positive changes have resulted:

- The overall administration of the maintenance program has improved drastically because contracts must be developed for most major works, including the work obtained by the DLOs. Accordingly, the work is much more clearly defined.

- The level of supervision has increased. This has been accommodated with a gradual shift of staff from maintenance worker to technician or engineer.

- Many DLOs have become much more efficient.

- A recent study of the Audit Commission indicates that the increase in competition following the regulation changes in 1987 and 1988 has brought benefits to local
authorities in terms of cost savings without, in general, significant effects on quality.

The lane rental awarding criteria has proven to be highly effective in motivating contractors to increase their rate of output.

In general, snow and ice control is considered a critical operation that must be performed by government agencies. Therefore, the size of force account maintenance units is often determined by winter maintenance needs.

The replacement of some local road authorities in the management of the national network maintenance by consulting enterprises is an innovative and interesting development towards further privatization of road management.

Based on the condition of the national network, it appears the DTP operates a successful road and bridge maintenance program.
I. INTRODUCTION

The substantial increase in contracted road maintenance experimented in France during the last six years is the result of changes in the road administration brought about by two political decisions: decentralization and reduction of some public services.

Prior to 1985, the national and department road networks (about 380,000 km) were administered by the Ministry of Infrastructure, Transport, Housing and the Sea through its local road directorates. In 1982 a decentralization law established for many activities a transfer of power and responsibilities from central government to the local governments of the 96 departments (or counties) in continental France and 6 additional departments overseas. The same law also regulated and strengthened the authority of the 36,000 elected communal governments. Specific measures to comply with the law in the different sectors were prepared and enacted during the following 3 years. Although the effective reorganization of road administration started in 1985, the transition is still underway in some respects.

In the early 1980s another national policy was taken to increase the number of public servants in the Ministry of Education without increasing overall public service level. To accommodate this policy, other ministries, including the Ministry of Infrastructure, Housing and the Sea, were required to reduce their staff size on average by about 1% per year in the past 10 years. The latter Ministry focused most of its reductions on the maintenance program. In fact, it has decreased the number of road maintenance personnel by 1.5% per year over a 10 year period. The effects of this policy, coupled with the substantial increase of traffic and the decentralization effort, has significantly reduced the Ministry's ability to perform force account maintenance. The Ministry has responded with efforts to increase the efficiency and productivity of its road maintenance forces, and by making greater use of contract maintenance.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

The Ministry of Infrastructure, Transport, Housing and Space (new name) remains the organization primarily responsible for the road network at the national level, although many of its former responsibilities have been transferred to the departmental and communal governments. Each department, headed by elected officials of the "General Council of the Department," is fully responsible for the maintenance of departmental roads within its boundaries.

The national road network comprises 8,000 km of expressways (about 4,500 km of which are toll-concession facilities) and about 28,000 km of national road. The departmental network
comprises about 350,000 km of departmental roads. All national and departmental roads are paved. The communal governments are responsible for about 100,000 km of urban streets and about 500,000 km of rural road, receiving technical assistance from the departmental road organizations and several offices within the Ministry.

The Ministry does not distinguish between routine and periodic maintenance. Instead, they use the terms "preventive maintenance" which is undertaken in a timely manner to prevent deterioration and substantially extend road life, and "curative maintenance" which is needed only when preventive maintenance has been neglected for a long period of time.

In 1968, the Ministry began a program to upgrade the entire 28,000 km network of national roads. This program included improving the facilities to meet required width and safety standards and providing frost-resistant pavements designed to accommodate heavy truck loadings even after a severe winter. As of 1990, work was completed on over 22,000 km. Preventive maintenance is provided on these upgraded facilities, while curative maintenance is required on the remainder of the network.

**Maintenance Organization**

The Directorate of Roads [Direction des Routes (DR)] of the Ministry is responsible for the overall management of the maintenance program. It focuses on policy and budget issues at the national level. In the performance of its duties, DR relies, in accordance with the general organization of the Ministry, on two types of services: the Research and Technical Services, and the Administration and Execution Services.

The research and technical services related to roads are performed at the central level by the Transport and Roads Engineering Department [Service D'Etudes des Transports et Autoroutes (SETRA)] and the Public Works Central Research Laboratory [Laboratoire Central des Pons et Chausées (LCPC)]. In addition, four other technical services deal with transportation and safety research, urban transport, tunnels and the supervision of the three national colleges for civil engineering. At the regional level, the research and technical services are performed by 7 regional infrastructure engineering centers [Centre d'Etudes Techniques de l'Equipement (CETE)] that provide technical support to the State and Departments within their areas.

The administrative services are structured into 22 Infrastructure Regional Directorates [Directions Regionales de l'Equipement (DREs)]. Each DRE comprises between 2 and 8 Departmental Infrastructure Directorates [Directions Départementales de l'Equipement (DDEs)]. These DDEs, one per Department, are directly responsible for maintenance of both national and departmental roads. Most DREs and DDEs managers and engineers are employees of the Ministry positioned at these regional and departmental organizations and are rotated at least once every five years between headquarters, DREs and DDEs to maintain their strong technical and career links with the Ministry. However, since 1985, about 10% of their staff has been
transferred to the new departmental technical services (STDs) to deal with departmental road policies, new construction, maintenance, and operation.

In addition to their responsibilities for maintenance of national and departmental roads, the DDEs, along with the CETEs, provide some administrative, technical and equipment support to the communal governments. Each DDE comprises of the following:

a) Central office, each headed by a Director who is responsible for managing activities for several infrastructure sectors (such as roads, housing and town planning) within the department. The chief of the road service within the central office is called the RGR (Responsable de la Gestion Routière).

b) Equipment park (parc), each typically with about 80 operators and mechanics plus an administrative staff. The parcs procure and maintain equipment with a dual purpose: (i) to serve as central equipment depots for, among other groups, department forces that maintain national and regional roads; and (ii) to execute themselves specific operations, mainly road maintenance operations like surface dressing and road marking. Each department contributes funds, equipment or materials to the parc, based on agreements with the Ministry. The Ministry also contributes to the parc, and receives services for the national roads commensurate with the level of contribution. In fact, the Ministry has the ability to impact the overall use of force account maintenance by changing its contributions to the parcs. The parcs can also provide service to communal governments, which must reimburse the cost. The parcs manage their operations by charging to the users of their equipment or services rates that have been calculated to cover all expenditures, including cost of equipment replacement or service of commercial credits taken for purchase of equipment. There are cases where the parcs produce surpluses that are transferred to the departmental treasury. On the other side, the rates charged by the parcs compel the subdivisions to plan and to make cost-effective use of the rented equipment.

c) Subdivisions (about 13 per department) which consist of maintenance workers and administrative staff. They are commonly headed by an engineer. Subdivisions are typically composed of 3 brigades, or working groups, each encompassing about 10 maintenance workers. Subdivisions have additional tasks related to other infrastructure issues. They have an important role of technical advice to mayors of small communities.

On average, each DDE is responsible for about 300 km of national roads and 3,500 km of departmental roads. Of course the extent of the network varies substantially among the DDE’s. The number of personnel assigned to each DDE also varies.

The DDEs follow general Ministry administrative and technical guidelines. However, the detailed organization and the work procedures and assignments are determined after
Discussions with the General Council of each department, so they vary substantially. In fact, the decentralization law has led to the adoption of a wide variety of organizational structures among the DDEs, as well as the use of a wide assortment of administration approaches to road and bridge maintenance. This diversity appears to be growing. The road sector in France has become a laboratory of highly diverse approaches and experiences. To monitor and guide this dynamic process, the Ministry has established separate working groups or committees to focus on decentralization efforts, modernization of maintenance and agreements with local authorities. (Among them, the "Permanent Committee for Road Maintenance" aimed at the modernization and increased efficiency of road maintenance in a multi-disciplinary and inter-hierarchical framework.) In addition, the directors of the DDEs, of the STDs, and the staff of the technical services (SETRA, LCPC and CETEs) have formed the Association for Exchange of Experiences on Departmental Roads (Club d'Exchange d'Expériences sur les Routes Départementales), which works similarly to the AASHTO in the U.S.

Maintenance Planning

The DDEs are responsible for planning, programming, and scheduling of maintenance works for national roads. For departmental roads, these tasks are performed in coordination between the DDEs and the newly created STDs. For major periodic works, the departments request assistance of the appropriate CETE in performing surveys and investigations to clearly define the deficiency to be addressed. SETRA, through the CETEs is responsible for the review of the DDEs proposals and for establishing national priorities for significant maintenance projects.

Maintenance Budgeting

The total average annual maintenance expenditures amount to between 230,000 and 530,000 francs per km for motorways, about 90,000 francs per km for the national network, and about 29,000 francs (1US$ = 5.57 francs) per km for departmental roads. However, in recent years, financing for roads has decreased, in real terms, by about 5% per year. The Ministry applied most of these reductions to the maintenance program. This practice could lead to an overall deterioration of conditions of the networks in the future.

Nationally, a lump sum budget is provided for national road maintenance. The budget is allocated rather evenly among the DRE’s. The DRE’s, in turn, distribute funds to the DDE’s and, in consultation with the General Council of each department, recommend allocations to the parc and the subdivisions of each DDE. The distributions are commonly based on previous budgets or relative amounts of pavement surface area, rather than on assessed needs.
III. CONTRACT MAINTENANCE

General

A study undertaken by a work group, considering all asphalt pavement layers of less than 8 cm thickness as maintenance works, revealed that the use of contract and force account maintenance nationwide is as follows (expenditures are for 1989, reported in millions of francs):

<table>
<thead>
<tr>
<th></th>
<th>National Network</th>
<th>Departmental Network</th>
<th>Communal Network</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Force Account</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FF (million)</td>
<td>1,700</td>
<td>6,700</td>
<td>1,500</td>
<td>9,900</td>
</tr>
<tr>
<td>(%)</td>
<td>52</td>
<td>80</td>
<td>43</td>
<td>65</td>
</tr>
<tr>
<td><strong>Contract</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FF (million)</td>
<td>1,600</td>
<td>1,700</td>
<td>2,000</td>
<td>5,300</td>
</tr>
<tr>
<td>(%)</td>
<td>48</td>
<td>20</td>
<td>57</td>
<td>35</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>3,300</td>
<td>8,400</td>
<td>3,500</td>
<td>15,200</td>
</tr>
</tbody>
</table>

The 20% level of contract maintenance for departmental roads represents about half of all contract maintenance nationwide. The study also showed that 65% of surface dressing work, 20% of routine maintenance for national roads, and all bituminous mix work was performed by contract.

However, these maintenance expenditure statistics may be misleading. In fact, it is somewhat difficult to assess expenditures for road maintenance because of the accounting methods used by the departments. Most road activities are classified into either financing code 901 (investments) or code 936 (maintenance) but there is no clear guidance to define the codes to be used to fund the various work activities. There is a significant difference between the two categories, though. The departments can retain the 18.6 percent Value Added Tax (VAT) for code 901 works, but for code 936 activities the VAT must be passed to the Central Government. This tax differential may serve as an incentive to use investment funds to provide for some activities, like surface dressing, that are usually considered as maintenance.

Traditionally, all maintenance work involving asphalt mixes has been done by contract (though one department owns and operates an asphalt plant). Most other operations were done by force account using equipment provided by the parcs and laborers employed by the subdivisions. In recent times, maintenance work is increasingly performed by contract.
Because of differences in local circumstances as well as political and economic considerations, the use of contract maintenance varies greatly among the 96 departments. While some departments have maintained almost exclusive execution of road maintenance by improved force account operations, others have turned almost completely to contracting. In between, a wide variety of combinations of force account and contract maintenance operations can be found. Within many departments the procedures for force account and for contract maintenance, and their relative mix are still evolving.

This great diversity is illustrated by the following table, which shows the uses of contracting and force account to perform various maintenance activities for the national network (the letter P indicates force account performed by the parcs while the letter S indicates work performed by the subdivisions):

<table>
<thead>
<tr>
<th>Pavement:</th>
<th>Contract (%)</th>
<th>Force Account (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pavement:</td>
<td></td>
</tr>
<tr>
<td>Routine Maintenance</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Surface Dressing</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>Bituminous Mixes</td>
<td>98</td>
<td>2</td>
</tr>
<tr>
<td>Shoulders and Right-of-Way</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Safety Features</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Structures*</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Winter Maintenance</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Traffic Management</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

* Routine maintenance only

A similar estimation for maintenance of departmental roads is not available.

In fact, it is very difficult to compare the cost of force account operations with contract maintenance. While the parcs, for the most part, collect detailed information about operating costs, most subdivisions just collect and average out cost ratios for the main activities with the help of a microcomputer program accepted nationwide. A few departments and the Association for Exchange of Experience are gathering unit cost information that should be helpful.

An interesting analysis was carried out by the Association for Exchange of Experiences to compare the cost structure of maintenance operations performed by force account teams and contracting teams having the same size and similar productivity. This analysis led to the conclusion that the differences in costs were caused by the following intrinsic rate differences of both execution modes: a) value added tax; b) salary levels; c) equipment amortization; (d) overheads; and e) benefits. The combined effect of these differences was estimated to result in force account costs being 15% to 18% lower than contracting costs. However, these
differences could not be clearly established, mainly because: a) higher complexity of not easily standardized tasks performed by force account led to lower productivity; b) at present the productivity of force account equipment is lower, however, the use of new highly effective equipment is increasing and may offset this relation, and c) force account units also perform public service tasks for which rentability can not be easily measured.

The Ministry's effort to improve road maintenance efficiency and productivity is probably most clearly demonstrated through its comprehensive program to improve the use of equipment. A wide variety of high production equipment, from mowers to surface dressing distributors, has been introduced. Some of this equipment has been developed through joint efforts between the Ministry (including DDEs), contractors and equipment manufacturers. Changes to procedures or practices have also been adopted in response to suggestions from workers at all levels. Employees of the DDEs seem to be concerned about costs.

The Ministry provides general directives on contracting policy; for instance it recommends that curative maintenance of the national roads should be carried out by force account (52% of all maintenance actually is executed by force account). On departmental roads ultimate decision power concerning nature and extent of maintenance activities to be executed by contract rests with the General Council of each department. Work on the departmental roads may be performed by force account, based on the department's contribution to the parc. The communal governments may also request the use of DDEs' forces to perform maintenance of their facilities, but this work is only performed when resources are available. As previously noted, the communal governments must reimburse the parcs for work performed under this method. A special system allows some of the overhead costs and benefits earned by the parc when it works for the communes, to be distributed to all DDE personnel as a supplement to the salary. This system enables to reduce the difference in salaries between the private and the public sector and is important to help retain valuable staff in the public sector and in the field.

While practices vary greatly among the departments, there seems to be an overall trend to contract those items that can be easily quantified and measured. Force account work is concentrated on small scattered or isolated activities that are probably not attractive to the private sector. The mix between force account and contract is also strongly influenced by the historical background. In some areas (Bretagne, for example) the parcs are strong because after 1945 there was a need to create a road maintenance production capacity, and the contracting industry was missing. Around large cities, particularly around Paris, the situation is the contrary.

There seems to be a widely accepted position that sufficient force account resources should be retained to ensure the DDEs can respond to winter maintenance as well as to other small emergency and incidental needs. In fact, winter maintenance needs determine minimum staffing and equipment levels in most departments.
Contract Provisions

Because of decentralization, a wide variety of contract provisions and contracting procedures is used. Most contract maintenance operations, particularly periodic maintenance, use unit price contracts. Under this method, detailed estimates of work quantities are provided.

Some innovative contracting practices are used. For example, one department provides unit prices along with a total cost estimate, which is based on a theoretical bill of quantities. These unit prices are established with input from the Ministry and the contracting industry. The contractors submit a single percentage that is applied to either increase or decrease the department's estimate. The percentage offered by the successful bidder is then applied to each unit price to determine payments based on actual measured quantities. This type of contract also includes an overall minimum and maximum payment, along with assured quantities for mowing and winter maintenance. The range of potential contract values is rather large, but the risk is manageable because the successful contractor often enjoys a lever effect that helps him in obtaining additional maintenance contracts from the communal road authorities. The contracts have a 5 year duration, and the unit prices are adjusted annually based on a cost index.

In another department, all maintenance activities requiring asphalt mix are included in 3 year contracts. However, the DDE provides aggregate procured by separate contracts. In fact, one contract is used to provide aggregate for work on the national roads while ten contracts are used to accommodate needs on departmental roads. Apparently, this arrangement is used to deter any one supplier from establishing a monopoly in a region where several aggregate sources are available.

The contracts sometimes provide for specific types of work at specific locations. This practice is commonly used for major periodic maintenance contracts. Contracting of specific activities for entire road segments or geographical areas is also frequently used. The duration of the contract varies, from a few months for specific period maintenance activities, up to 5 years.

Standard contract documents are often used. However, the standards vary among the departments.

Tendering of Contracts

Maintenance contracts are usually developed by the DDEs. Smaller contracts are sometimes prepared by the subdivisions. In general, maintenance contracts are solicited through open competition. However, the procedures used to tender contracts varies. However, for specific activities, contractors can be selected, in particular cases, based on technical skills in addition to cost. Alternative tendering procedures can be used in some cases. For instance, a call for interest may be issued. Based on the response, tenders may be solicited from a select group of contractors.
Contracts are advertised in a national publication, and occasionally in other industry journals as well. Small maintenance works (less than 300,000 francs) that are contracted at the departmental level do not have to be advertised.

**Supervision**

Supervision is provided by the DDEs. Full time inspection is used on major maintenance contracts and spot reviews are used on less complex operations. Supervision through upstream control of contractor’s equipment and quality of aggregate production at the source is highly developed and has succeeded in increasing productivity and diminishing failures.

**Transition from Force Account to Contract Maintenance**

The transition from force account to increased use of contract maintenance has been taking place gradually over a number of years. Therefore, it has not caused major disruptions to the Ministry’s employees or physical resources. The number of personnel has been reduced through significantly reduced hiring of new employees. This practice has been successful, the overall staff of the Ministry has been reduced from about 45,000 in 1985 to about 39,000 in 1989. The reductions have been concentrated on maintenance workers rather than engineers. Since during that period, a number of new tasks were added to the traditional ones for maintenance, the real increase in productivity is much larger than the ratio of the personnel figures.

One DDE reported it increased the use of contract maintenance, and accommodated the change by reassigning workers to maintenance of motorways. This allowed the department to improve the level of service provided on the motorway routes. However, in the increased use of contract maintenance on other roads, the DDE noted that some activities formerly performed by force account were not adequately considered in the development of the maintenance contracts. Accordingly, some minor, miscellaneous maintenance items were not performed.

**Assessment of Experience with Contract Maintenance**

Some departments felt that they could obtain better quality from force account operations as compared with contract maintenance. For instance, one department reported that mowing contractors had a tendency to concentrate on longitudinal mowing along the road and not to perform more time consuming mowing around signs, posts and other fixtures or in areas difficult to reach. This documents the need for more detailed specifications. Other departments indicated they believe force account operations are less costly. However, because developments have taken place so quickly during the past few years, it has not been possible to monitor the diverse collection of practices throughout the country. Although a great deal of information about operating costs is available within many departments, attempts to gather this information at the regional or national level have not been completed. An effort is underway to develop a comprehensive data bank to assist in making a detailed assessment of achievements and
experience. Hopefully, this will lead to development of guidelines on the use of contract maintenance.

Contractors' Viewpoint

a) France has traditionally had a strong civil service. This is rather unique to France. The civil service is accustomed to taking decision and execution processes into its own hands. The development of the contracting industry started around the beginning of this century, much later than in most other developed countries. The contracting industry developed the quickest in areas where the administration was unable to satisfy demand (for instance in the metropolitan Paris area).

b) Prior to the 1950's, contractors were allowed to use seasonal personnel to take care of peak work loads. That is, a large portion of the labor work force was transitory. In recent years the contractors have lost the flexibility to make quick changes in the size of their work forces. Legal and labor constraints force contractors to be cautious in hiring people. Therefore, they manage their work to make full use of workers throughout the year. However, within the last two years, a new opportunity has developed to allow contractors to hire people and equipment on a short-term basis to handle peak work periods.

c) The need to provide continuous employment to a stable workforce throughout the year, has increased the contractor's interest in winter maintenance.

d) In general, maintenance contracts are packaged to include work that is of interest to contractors separate from work that is less profitable. Accordingly, most less profitable work is performed by force account. To increase the overall amount of work that can be successfully contracted, less desirable maintenance activities should be combined, in small quantities, with other work that is attractive to contractors.

e) For the most part, maintenance contracts are of insufficient duration to allow contractors to amortize the cost of new or specialized equipment.

f) Clear specifications and good quality control are essential to contract maintenance. Sometimes this is an area of weakness.

g) Performance specifications are preferable to method specifications because they allow the use of innovative technical approaches and the introduction of sophisticated equipment.

h) Contractor selection procedures should be modified to shift the emphasis from cost to technical capabilities.
i) To attract more contractors to maintenance work, contracts should be expanded in scope and duration to include all maintenance activities in specific areas. It may be worthwhile to consider the use of contracts expanded into concession-type packages. Local contractors could concentrate on such works at the local or regional level, while national or international contractors could focus on larger contracts.

j) Overall, contractors are interested in performing winter maintenance. Contracting of snow and ice control activities would enable contractors to make greater use of their resources during the winter. Moreover, this would allow further reductions in the size of the Ministry.

IV. SUMMARY AND CONCLUSIONS

A national policy has, in effect, required significant reductions to the number of personnel within the Ministry of Infrastructure, Transport, Housing and Space. The effects of this policy, coupled with the increased maintenance needs and implementation of a decentralization program, has reduced the Ministry’s ability to perform force account maintenance. The Ministry is responding with a two pronged approach. It is increasing the efficiency and productivity of its road maintenance forces and making greater use of contract maintenance.

The Ministry’s effort to improve its efficiency and productivity has led to the adoption of some significant improvements to both management practices and technical approaches to maintenance work. This includes development of innovative, more efficient equipment through joint efforts of the Ministry, contractors and equipment manufacturers. In many cases, the effectiveness of force account operations has improved to a level that they are probably competitive with contract maintenance.

The decisions to use contract maintenance, and the selection of activities to be included in the contracts, are made by the 96 departments. Because of differences in local circumstances and political and economic considerations, the use of contract maintenance varies greatly among them. Some departments make almost exclusive use of force account maintenance, while others have turned almost completely to contracting. A wide variety of practices exists between these extremes.

While practices vary greatly among the departments, there seems to be an overall trend to contract those items that can be easily quantified and measured. Force account work is concentrated on small scattered or isolated activities that are less attractive to the private sector.

The transition from force account to contract maintenance has been taking place gradually over a number of years. Accordingly, it has not caused major disruptions within the Ministry.
I. INTRODUCTION

Since the early 1980s, there has been a steady increase in the contracting of regravelling and resurfacing works in Kenya, accounting now for 89 percent of total periodic maintenance expenditures. The Ministry of Public Works (MPW) has also developed an effective system to carry out routine maintenance of low volume roads by contracting lengthmen, each assigned 1.5 to 2.0 km of roads. However, this development of contracting has failed to reduce force account manpower and equipment.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

MPW, through its Roads Department (RD), is responsible for the maintenance of the classified road network of 62,290 km, of which 1,280 km are paved with asphalt concrete, 6,660 km are asphalt surface treated, 25,700 km are gravel, and 28,650 are earth-surfaced. Of the paved roads, about 12 percent are in good, 30 percent in fair, and 58 percent in poor condition. About 60 percent of the gravel and earth roads are maintained at all-weather road standards. The remainder is subject to seasonal interruptions. There are also some 97,000 km of unclassified roads - earth tracks allowing only dry-weather traffic - which fall under the jurisdiction of the county councils and are largely unmaintained.

The 1991 recurrent budget of Ksh 540 million (1US$ = Ksh 28.4) for the classified network provided Ksh 329 million (about 60.9%) for administration, salaries and overheads, Ksh 53 million (9.8%) for routine maintenance, Ksh 46 million (8.5%) for periodic maintenance of roads and bridges, Ksh 44 million (8.2%) for maintenance of rural area roads, other agencies and municipalities, Ksh 35 million (6.5%) for maintenance of camps equipment and equipment purchase, Ksh 7 million (1.3%) for ferries and Ksh 26 million (4.8%) for emergency provisions. This meager and ineffectively distributed maintenance budget allocated by the treasury is substantially supplemented by the toll fund revenue that is estimated to produce in 1991 a net amount of about Ksh 300 million to be used exclusively for periodic maintenance activities of the paved road system.

The MPW, has several technical and administrative departments or divisions. Those directly concerned with roads are: a) the Road Department, which is headed by the Chief Engineer (Roads) and is organized in four main branches: Design, Construction, Special Projects, and Maintenance, each headed by a Chief Superintendent Engineer (CSE), and b) the Technical Division through its Materials and Mechanical and Transportation branches. The MPW carries out its activities in the field through 46 districts, each headed by a District Work Officer, who oversees several officers in charge of different branches; one of which is the
District Road Officer in charge of routine and periodic maintenance. Each district has a District Development Committee (DDE), chaired by the District Commissioner, comprising technical personnel from various ministries, including the District Works Officer (DWO), the members of Parliament, and representatives of local and non-governmental development related organizations. The DWO advises the DDC on matters related to MPW works and services.

The Road Department and other road related branches are overstaffed, there are only 289 engineers, and approximately 13,000 permanent employees. About 61% of the recurrent budget goes to paying wages and overheads. Wages are paid directly to each employee from the MPW headquarters. At present, road maintenance in the Districts is undertaken from a series of camps and depots totalling over 300, which fall under the control of the particular DWO. In future, (July '92), a separate organization of depots will look after the paved roads.

The July 1992 reorganization will effectively split the National Classified Road System into two distinct networks. One network, consisting of the bulk of the paved roads will be controlled and maintained under the direction of the CSE Maintenance who will use, where appropriate, the services of the Provincial Works Officers. Funds for paved road maintenance will not be handed over to the districts as has been the case in the past, but will be controlled by headquarters. Maintenance of gravel and earth roads will fall under the CSE Special Projects, and through the provisions of the Roads 2000 project, labor based methods will be introduced for maintenance of low traffic volume roads in those districts with the appropriate population characteristics. Funds for maintenance of these roads will be channelled through the District Organizations.

Maintenance Planning

For functional purposes, the classified road network of 62,290 km is at present divided into trunk roads (6,330 km), primary roads (7,770 km), secondary roads (11,120 km) and minor roads (37,070 km). The routine maintenance planning for the trunk, primary and secondary roads, totalling 25,220 km, is the responsibility of the CSE of the Maintenance Branch and is performed with the recently installed Maintenance Management System (MMS), a computer based performance budgeting system. Ideal requirements, called "the benchmark" budget, are calculated, and the system allows front end prioritization utilities to develop current budgets which match the actual recurrent allocations issued by the Treasury. Maintenance needs are assessed on the basis of the feature inventory data base which is updated every year, and condition ratings which are updated yearly for the paved road network, and set at a constant "default" value for the earth and gravel roads. Quantity standards are modified by factors which take account of variations in climate, terrain, traffic flows, surface age and type. This information is supported by traffic counts and unit cost information for contracted work and is updated every year. The MMS interfaces with a new recently installed Equipment Management System (EMS).

According to the policy of "District Focus for Rural Development", enacted in July 1980 to transfer responsibility of the planning and implementation of rural development from headquarters to the districts, responsibility for maintenance planning for minor roads has shifted
progressively to the District Development Committees, and will further shift under the proposed reorganization.

**Maintenance Budgeting**

The maintenance budget request is prepared through estimation of the physical maintenance requirements, based on road inventories carried out in the districts. Real budgetary allocations, however, have remained rather constant over the years and have decreased substantially, in real terms.

In an effort to mobilize additional resources for the maintenance of roads, the government in 1984 enacted the "Public Road Toll Act" to provide for the collection of tolls on specific public roads. Of the 15 toll stations planned, eight were operational in 1988 and collected a total of Ksh 114 million in the fiscal year 1987/88, which is expected to increase to Ksh 300 million in 1991, of which 10% covers collection costs, including station maintenance, vehicles, security, etc. Wages for collecting staff are not included in this 10%.

### III. CONTRACT MAINTENANCE

**General**

Contract maintenance started in the mid 1970s with the execution of regravelling works by small domestic contractors. It was hampered in its development by the irregular flow of works put to contract as a result of budgetary constraints. The contracted regravelling program financed through recurrent allocation peaked in 1980 with more than 1,000 km but dropped to 300 km in 1983, and is running at about 200 km per year. External funds finance another 200/250 km per year executed by force account. The Minor Roads/Rural Access Graveling Program is at present accomplishing approximately 500 km per year mainly through the provisions of external finance and performed by contract. Under the Bank’s Highway Sector Project (Loan 2409-KE), Kenya strengthened its regravelling program in 1986 and expanded contracting to a substantial resealing program. At present, most of the periodic maintenance activities undertaken on the paved road system involve thin overlays. In fiscal year 1989/1990 approximately 500 km of sealing/thin overlays was done, in fiscal year 1990/1991 the figure dropped to about 300 km, which is the same figure expected this year. These programs account for about 89 percent of total periodic maintenance expenditures. The remainder of periodic maintenance is carried out by force account.

For the execution of routine maintenance and minor emergency and rehabilitation works on gravel and earth roads, Kenya has contracted lengthmen, usually former construction workers, each of whom, using simple hand tools, maintains 1.3 to 1.5 km of road. At present, there are about 7,000 such lengthmen who undertake maintenance of 10,000 km of rural access roads in 28 of the 46 districts in the country.
Contract Provisions

Periodic road maintenance is contracted through "unit price" contracts for specific maintenance activities in an area, with a duration varying from 3 to 12 months because contracts cannot be carried forward from one fiscal year to the next. They are prepared using a standard bidding document based on standard specifications, which are more stringent than those used for force account operations. Bills of quantities are clearly defined and unit costs are offered by the bidder. The contracts may include items for supply of materials, labor and equipment; however, sometimes these items are contracted separately.

Lengthmen are contracted on an annual basis for sections of gravel roads close to their homes and are expected to work three days per week on days specified by their supervisor. They are provided hand tools and supervised twice a month by an overseer who monitor if the condition of the road complies with specified standards, authorizes payments and sets tasks for subsequent grant periods. If the work is not satisfactory, payment is postponed until it is correctly carried out. Consistent failure of satisfactory performance is penalized with termination of contract.

Performance Bond, Guarantee, Retainage and Warranty Period

The requirement of Performance Bonds required for resealing works has not constrained participation by contractors. No performance bond is required for regravelling works or from lengthmen. Retainage of a certain percentage of payments as an additional guarantee is not used. Defective materials or works are rejected. Resealing contractors are required to provide maintenance for a full year after work execution.

Tendering of Contracts

At the beginning of the regravelling program, contracts were awarded at fixed rates set by MPW and only to contractors assigned to a given district. This system has been replaced by competitive bidding advertised in all major local newspapers. Only contractors registered in a requisite specialty and category are pre-qualified to participate in bidding. On average, five contractors participate per bid. The entire process, from preparation of bids to initiation of work, takes place within a period of about eight months.

At first, only small contractors participated in the regravelling program. With the start of the resealing program, participation expanded to medium-sized construction contractors and has remained stable over the last three years.

Supervision

Supervision is carried out by in-house personnel at the district level using spot reviews to monitor quality of work and by monthly measurement of work to prepare payment statements. A project engineer from the Maintenance Branch and personnel of the Materials Branch oversee the tasks performed by the district field supervisors. Supervision of lengthmen is provided by
one inspector for every 300 lengthmen, assisted by three overseers, a clerk and a driver. Each inspector is assigned a pick-up truck and each overseer a motorcycle.

Payment Procedures

The contractors submit monthly estimates of quantities for payments which are reviewed by the district personnel. Bills are usually paid quickly; however, payments are occasionally delayed by constraints in the availability of funds. District authorities make special efforts to pay lengthmen on time at the site.

Transition from Force Account to Contract Maintenance

The decision to use contract maintenance was taken primarily as a means to overcome inadequate availability or poor utilization of force account equipment, and to improve quality of work. Secondary reasons were the desire to improve efficiency and to reduce staff, and the need for specialized equipment. Other factors contributing to this decision were the desire to resolve logistic problems and to obtain services at a lower cost, and recommendations by international lending organizations.

The type of work to be contracted depended upon the availability of resources to perform the work, namely, experienced and capable contractors and inspection and control capacity. Others reasons were ability to define and measure the work to be performed, the expectation to improve reliability and quality while reducing the cost of work and, finally, amount, location and concentration of work.

The transition from force account to contract maintenance has taken place over a number of years and has been mainly geared to satisfy an increasing maintenance workload. Therefore, it has not induced reduction of force account manpower or equipment.

With the purpose of supporting the development of the construction industry, MPW offered, at the start of the regravelling program, special training to the emerging contracting groups and continued this effort until a satisfactory level was reached. To increase interest of the construction contractors in the resealing program, MPW has furnished to them hard-to-get asphaltic products.

To foster development of managerial skills for the road sector in general, and road maintenance in particular, MPW established a Technology Unit and a Minor Roads Training School. The Technology Unit has been established to investigate various technical and organizational aspects of the Minor Roads Program and coordinate the studies undertaken by consultants. The results have been disseminated through the revisions of the Technical Manual, and through courses and seminars. The Minor Roads Training School, directed at the training of personnel in the Minor Roads Program in labor-based methods of maintenance, was expanded in April 1989, offering both theoretical and practical courses, and operates model construction and maintenance sites for trainees.
A review of the lengthman system in Kenya has led to establishing the following general conditions to ensure success:

- maximum use of casual labor in the vicinity of the road;
- planning routine and periodic maintenance within budget provisions;
- minimum form filling, reporting and administration requirements commensurate with good planning and control;
- less dependency on availability of supervision vehicles;
- effective control of the lengthmen's work output and quality; and
- implementation of formal and on-the-job training to be carried out for all levels of personnel compatible with their background, previous experience and understanding of maintenance.

MPW is satisfied with the results achieved so far in contracting regravelling and resealing work and with the lengthman system for routine maintenance, and expects to develop them further, particularly, extending the lengthman system to maintenance of additional roads under MPW jurisdiction in districts with appropriate population characteristics.

IV. SUMMARY AND CONCLUSIONS

Development of road maintenance in the last ten years has been characterized by a substantial shift in responsibilities from headquarters to the districts, by a gradual increase of contracting for regravelling and resealing/light overlays and by the development of the lengthman system for contracting routine maintenance. However, these developments have failed, so far, to bring about a substantial reduction in chronic overstaffing or to satisfy the increasing maintenance requirements of the road network.

Consistent budgetary insufficiencies have been partly overcome by collection of tolls on certain main roads. This process is still developing and subject to improvement of its cost-effectiveness.

Periodic maintenance is contracted on a "unit price" basis and is being expanded to contracting other periodic maintenance activities besides regravelling and resurfacing. Routine maintenance is contracted for specific road lengths to individuals on a time basis, and is paid after monthly supervision of quality of work performed.

The decision to contract maintenance was taken primarily for reasons related to poor utilization of force account equipment and improvement of quality of work. The type of work
to be contracted depended upon the availability of resources to perform the work, namely, experienced and capable contractors, and inspection and control capacity.

The transition from force account to contract maintenance has taken place slowly over a number of years and has failed to reduce force account manpower or equipment.

To foster development of the contracting industry, MPW provided, at the beginning, training to emerging contractors and, later, asphaltic products to carry out resealing work.

The development of the lengthman system for routine maintenance has allowed the formulation of general conditions that are necessary for its successful implementation.
MALAYSIA

I. INTRODUCTION

Since 1974 Malaysia has increased the use of contract maintenance to carry out the maintenance of its federal road network, reaching a level of 52% in 1991. This gradual transition from force account to contract over the years has provided a smooth process that allowed the contracting industry to adapt progressively to increasing demands and has avoided major disruptions in public sector employment.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

The Ministry of Works (MOW), through its Public Works Department (PWD), is responsible for maintenance of the federal road network, composed of 13,060 km of roads, of which 10,310 km are paved (mostly asphalt concrete), 1,310 km are gravel and 1,440 km are earth surfaced. It also supervises the toll-concession motorways system (400 km in operation and about 400 under construction). The State Road Authorities of the 14 states are responsible for maintenance of 38,105 km of state roads. Other regional authorities are responsible for an undetermined length of feeder and penetration roads. The current budget for the federal road network, amounting to M$ (ringit) 495 million, is distributed 60% (300 million) for new construction, 15% (73 million) for rehabilitation, and 25% (122 million) for maintenance, equally divided between periodic and routine maintenance (US$1 = M$2.78).

The MOW is divided at headquarters into two departments: (i) the Public Works Department (PWD), headed by a Director General, which is responsible for nine infrastructure directorates; and (ii) the Malaysian Highway Authority, (MHA), which is responsible for the toll-concessions motorway system. The Board of Engineers, which also comes under the purview of MOW, is responsible for registration and monitoring the performance of all engineers, fees for consultants and all legislative matters related to engineering practice. Whereas, the registration and monitoring of performance of all contractors is handled by the Contractor’s Service Center in the Prime Minister’s Department. The Public Works Department maintains in each state a local Public Works Department with a similar structure, which is responsible for the federal and state projects within each state. The Road Directorate is one of the nine infrastructure directorates at headquarters, and is subdivided into two main branches, one (under the Deputy Director) responsible for operations, and the other (under the Senior Superintendent Engineer), for design. The operational branch has six divisions, one for administration, one for rural roads, one for maintenance and three for investment projects in the three regions: north, central and south.
Maintenance Organization

The maintenance division of the Road Directorate at headquarters has three subdivisions (one for maintenance programs, one for management systems and one for mechanical support) and provides overall management and direction for the maintenance program. It focuses on policy, budget, and technical issues at the national level. It also handles bidding and payments of all maintenance contracts above M$5,000,000.

Maintenance operations are administered by the local Public Works Department in the 13 states and in the Federal Territory of Labuan, through their respective Road Directorates, which are divided into three sub-directorates: roadside development, maintenance and special projects. These road directorates are responsible for detailed managing of the maintenance program for the federal road network. In particular, they are responsible for establishing priorities at the regional level for administering force account maintenance, for managing all maintenance contracts and contracting directly works valued under M$5,000,000. They work closely with the state authorities and assist in the monitoring of maintenance of the state road network.

Each local Road Directorate is administratively divided into several districts, each of which is managed by a civil engineer. There are in total 71 districts, which for maintenance purposes are subdivided in turn into two or more areas.

Maintenance Planning

The maintenance planning for the federal road network is carried out using the BSM (Burrow Snaith Maintenance) system based on a detailed survey of every 200 m section of road divided in 25 m intervals. Each year the area offices record the type and extent of deterioration at 25 m intervals and average the data for each section. This information is passed through the State PWD to headquarters, where it is compiled with traffic information for the respective road (ADT values arranged in 8 levels without information on vehicle classification) and fed into the computer program. Priorities are assigned based on trigger values without reference to costs or to alternative maintenance policies. The cost of the selected projects is estimated using standard unit costs to establish budget requirements. A model for economic evaluation of maintenance and rehabilitation projects is being developed by the PWD and consultants.

Maintenance Budgeting

By March every year the Road Directorate prepares a budget request for the following fiscal year (January 1 to December 31) to be discussed in June with the Ministry of Finance. The agreed budget is presented in October for Parliament's approval. Usually the authorized budget is about 60% of the requested budget, and has not been sufficient in the past years. Increases have been lagging behind the inflation rates. However, there is some flexibility for the use of eventual surpluses in funding of investment projects for maintenance works.
III. CONTRACT MAINTENANCE

General

The efforts to carry out maintenance by contract were initiated in some pilot regions, in 1974 for periodic, and in 1985 for routine maintenance operations. They were later expanded nationwide and have been increasing steadily since. In 1991 about 52% of both routine and periodic maintenance operations are expected to be carried out by contract. Force account is used mainly for maintenance of pavement markings, traffic signs (erection, repair and maintenance) and emergency operations. It is also used to perform other maintenance operations, particularly in those areas where it has been difficult to obtain sufficient participation from reliable contracting firms. Whereas unit costs information of contract maintenance operations is adequately recorded and monitored, no attempt has been made to establish unit costs for force account operations.

Contract Provisions

Road maintenance is contracted primarily through "unit price" contracts of two years duration that are initiated preferably during the three first months of the year. The contracts include routine and periodic maintenance of specific roads. They are prepared using a standard bidding document following a FIDIC format and are based on standard specifications for the execution of road maintenance activities. Bills of quantities are clearly defined and unit costs are offered by the bidder. Flexibility is provided during contract execution to change, if necessary, some work quantities or to agree on unit costs for new items, as long as the total contract cost does not exceed the initial amount. Total cost increases of up to 20% may be exceptionally authorized by headquarters in some specific cases.

Most contracts cover all maintenance activities to be executed; however, there has been a tendency by many contractors to offer unbalanced bids with specific items at very low unit costs, and then to avoid execution of the corresponding works, and to try to apply the unused funding to execution of additional quantities of items with high unit costs. This has caused difficulties in the administration of several contracts and the Road Directorate considers subdividing maintenance contracts according to specific types of activities; separate contracts for pavement maintenance, for grass cutting and shrub trimming, for drainage maintenance, etc.

The Road Department also uses occasionally unit cost contracts for supply of material, labor and equipment and lump sum contracts for execution of small specific works.

Major contracts for road rehabilitation and overlays may also include some maintenance works items.
Performance Bond, Guarantee, Retainage and Warranty Period

The contractors are required to provide a performance guarantee equivalent to 5% of the contract price, and for periodic maintenance a warranty on workmanship and materials for a period that varies from 6 to 12 months. The request of the performance guarantee has not constrained participation of small contractors.

Tendering of Contracts

Invitations for competitive bidding are published in all major local newspapers. Only contractors registered in the corresponding specialty and category with the Contractor’s Service Center are allowed to participate. The bid award criteria is based not only on cost, but also on an evaluation of past performance of participating contractors.

Participation of contractors in bids is quite high, typically 15 for periodic, and 10 for routine maintenance bids, except in some isolated areas, where participation is lower. The entire process from preparation of bids to initiation of works takes place within a period of about 15 weeks for routine, and 17 weeks for periodic maintenance.

Overall, the contracting industry has demonstrated a reasonable amount of interest in contract maintenance. The pool of contractors has been increasing annually by about 10% and has not been restricted by availability of equipment, however, supply of spare parts has been problematic in some locations.

Supervision

Supervision is carried out by in-house personnel at the district level, using spot reviews to monitor quality of works and by monthly measurement of executed works to prepare payment statements. Overall coordination and supervision is provided by engineers of the Road Directorates at the state or headquarters levels. Laboratory personnel oversee quality of materials. No attempt has been made so far to hire contractors to assist the supervision efforts. The Road Directorate is planning to supplement its scarce supervision capacity by hiring of consultants, especially for major rehabilitation projects.

Payment Procedures

The contractors submit monthly estimates of quantities for payment, which are reviewed by the inspectors and at district level. Contractual requirements stipulate payments to be made within 30 days from date of measurement.

Transition from Force Account to Contract Maintenance

The decision to use contract maintenance was taken by the PWD following government policy to reduce public administration employment and taking into account the limitations of the force account staff and equipment to satisfy expanding road maintenance demands. There is a long term goal to reduce the size of the PWD. As the size of the government labor force and equipment fleet decreases, further increases can be expected in the amount of maintenance work
performed by contract. Very little attempt has been made to evaluate the cost-effectiveness of contract versus force account maintenance.

The transition from force account to contract maintenance has been taking place gradually over a number of years and has therefore not caused major disruptions in PWD's human or physical resources. The Road Directorate has been gradually reducing its personnel through redeployment and by facilitating early retirement at age 40 compared to the rather low mandatory retirement age of 55.

Obsolete equipment of the Federal Road Directorates is not being replaced except for some units required to keep a minimum fleet. In addition, the state governments have initiated privatization of government owned quarries including asphalt plants and paving equipment. Of the original 20 government quarries, three have already been privatized and two are presently going through the privatization process. Existing workshops and other real estate are not being reduced or disposed of, although it appears that little use is being made of some of them.

With the purpose of supporting the development of the construction industry, MOW and PWD supply consistent information on the increasing scope of the contracting possibilities and lends assistance, particularly to emerging small firms by:

(a) offering periodically courses on works and financial management;

(b) restricting participation in bids for small contracts to district residents; and

(c) by setting up a government supply financing agency (PERNAS) that pays suppliers for equipment and material acquisitions by small contractors and is allowed to amortize the debt incurred by the contractors through deductions from the monthly payments issued by PWD.

The contractors interviewed showed satisfaction with the existing arrangements and interest to continue participating in the contracted maintenance program.

IV. SUMMARY AND CONCLUSIONS

In general, the condition of the federal roads observed in the Kuala Lumpur area and in the northern region reveals that the Road Directorate has been more successful than most road agencies in developing countries to operate an adequate road and bridge maintenance program, reaching maintenance levels that are far superior to those of similar state roads. However, as maintenance budgets have not kept up with inflation and increasing traffic demands over the years, a reduction in levels of maintenance service may occur in the near future. The impact that excessive axle loads have had on pavement deterioration has been recognized and will be dealt with in the near future with assistance from the World Bank.
The Road Directorate is considering methods to streamline the complicated road inventory and pavement evaluation system it has adopted and is developing an adequate economic evaluation system for investment and maintenance projects. These efforts will lead to improvements of its planning and budgeting procedures and provide supportive economic information to obtain more adequate funding.

It appears that the decentralization of the decision level for programming routine maintenance and on the scope and type of contracting maintenance activities had a positive impact on the development of the maintenance program. On the other hand, it appears that there is room for an increase in the efficiency of force-account operations.

Special mention should be made of the gradual and smooth transition from force account to contract maintenance and of the concerted efforts deployed by MPW to assist the contractors in this transition.
PAKISTAN

I. INTRODUCTION

Since July 1987, all routine and periodic maintenance on the national highway system has been performed by contract. Before the introduction of the contract maintenance program, the work was performed by the provincial governments by force account. The transition was well planned, and a comprehensive but simple maintenance management system to identify needs and establish priorities, along with contracting procedures and uniform specifications and contract documents were developed and instituted in conjunction with the program. Moreover, many steps have been taken to enhance the capabilities of the domestic contracting industry.

II. ADMINISTRATION OF ROAD MAINTENANCE

General

The National Highway Board (NHB) was created in 1978, as an agency of the Ministry of Communications, to take responsibility for the national highway system. The provincial governments remained responsible for provincial roads. District and Municipal governments have responsibility for rural and urban roads respectively. At present, the national system consists of eight major routes that amount to about 6,620 km of roads. Other primary roads may be added to the system in the near future. The NHB was organized, and developed most of its procedures with technical assistance under a series of Bank's highway projects.

In early 1991, the NHB was reorganized into the National Highway Authority (NHA). As an authority, the agency has received much more autonomy. The NHA is headed by a Council that is presided by the Prime Minister. The agency is currently undergoing a reorganization.

Since initiation of the contract maintenance program in July 1987, 281 maintenance contracts have been let. While expenditures over the first three years (July 1987 -- June 1990) amounted to over 630 million rupees (U.S. $33 million equivalent), expenditures for the first 11 months of the current fiscal year totaled about 410 million rupees (U.S. $19 million equivalent).

Maintenance Organization

The NHA functions as a highly centralized organization. Maintenance is the responsibility of the Pavement Monitoring Unit in Islamabad, which is subdivided into groups that oversee administrative and coordination, pavement monitoring, computer support, contracts, and assessment of contractors' equipment. Sixteen field offices throughout the four provinces
manage the maintenance program at the project level under close monitoring by headquarters. Organization of four regional office is planned.

**Maintenance Planning**

The Maintenance Intervention Level (MIL) system is the cornerstone of maintenance planning for the national highway system. The system assigns numerical ratings that describe the conditions of the pavement sections. The information is used to determine maintenance needs, including the appropriate level of maintenance that should be provided, and to identify roads that require rehabilitation or reconstruction. The system provides an estimate of maintenance work quantities at the network level.

The MIL system is based on direct measurements of about 18 separate factors that relate to pavement condition, roughness, and strength, as well as climate, terrain, and traffic. Pavement condition surveys are performed annually along 1 km sections, each representative for 5 km length of roads. The system was developed with a strong emphasis on simplicity.

Final intervention scores are calculated in Headquarters, using severity factors that reflect the relative importance of various types of road deterioration and environmental influences. These scores are forwarded to the field offices, which undertake detailed surveys to identify quantities. Estimates of required maintenance work are developed based on these quantity estimates, using a database of unit costs for all types of works. This information is useful to quantify overall maintenance needs and develop budget requests. In addition, this information is useful in preparing overall work plans that reflect budget constraints.

Topographical survey plans have been prepared for most of the network. These plans provide a clear display of the network inventory and serve as a useful visual reference to indicate the location of needed maintenance or reconstruction work. In addition to their use as planning tools, these topographical survey plans are used to inform maintenance contractors of specific work to be performed.

**Maintenance Budgeting**

The NHA develops an annual budget request for maintenance, based on needs and priorities identified by the MIL system, as well as on detailed information about quantities and costs for work performed the previous year.

Prior to development of the MIL system, budgets were prepared using the "yardstick" formula, which provided a specific amount of money for each km of road, regardless of condition or need. Unfortunately, the Ministry of Finance approves budgets based on previous years' budget as adjusted for inflation. That is, the Ministry of Finance continues to use the "yardstick" method rather than a consideration of needs to establish levels of funding for maintenance.
The resulting differences between the requested and the approved budget requires a reassessment of the priorities identified through the MIL system to establish a readjusted maintenance program. Funds are assigned to the field office and contracting scheduled in accordance with this revised plan.

Appropriations and expenditures for maintenance have lagged significantly behind needs as identified by the MIL system. A large maintenance backlog still exists. While the maintenance budgets have increased during the past few years, they have not been adequate to compensate for the effects of inflation or the increases in traffic.

III. CONTRACT MAINTENANCE

General

The efforts to carry out maintenance by contract were initiated on July 1, 1987, for both periodic and routine maintenance. Since this date, all maintenance of the national highway system has been performed by contract. Prior to the contract maintenance program, the NHB transferred funds to the provincial governments, which, in turn, managed maintenance operations by force account.

Contract Provisions

Road maintenance is contracted almost exclusively through "unit price" contracts. Hourly reimbursement contracts are occasionally used for the supply of labor and equipment for execution of small specific works. Standard contract documents are used for five types of maintenance contracts: routine maintenance, periodic maintenance, emergency operations, and special operations (spot interventions in specific places), and mechanized operations (carried out exclusively with equipment). Standard specifications are continually updated to reflect research and experiences in the field.

Most contracts extend for a complete year. Because funds are limited, the field offices retain close control over the work to be performed. To manage the maintenance program within the allotted budget, the field offices identify priorities and develop work schedules which are updated monthly. Work is performed at the direction of the field offices, which issue individual work schedules that instruct the contractors to perform specific types of work at specific locations.

The bid documents provide a detailed estimate of work quantities. In addition, the specific work to be performed and the required overall level of effort is clearly defined. The contractors are allowed flexibility to use innovative techniques or equipment.

A mobilization advance of 10% is granted for routine and periodic maintenance contracts.
Performance Bond, Guarantee, Retainage and Warranty Period

For routine and periodic maintenance contracts, the contractors are required to provide a performance guarantee equivalent to 20% of the contract price.

For larger periodic maintenance contracts (greater than Rs. 10 million, or about U.S. $500,000 equivalent) 10% of each payment, up to a total of 5% of the contract value, is held in retainage. In addition, periodic maintenance contracts typically include warranty periods varying from 6 months to a year.

Tendering of Contracts

Periodic maintenance contracts are tendered using open competition. Routine maintenance contracts, however, are only tendered to contractors based in the area through which the road passes. For both types of contracts, contractors are registered based on equipment holdings and previous work experience.

The entire process from confirmation of quantities and preparation of bids to initiation of works takes place within a period of about 2 and one half weeks for both routine and periodic maintenance contracts. Emergency contracts can be developed and executed within one day. The process is greatly simplified with the use of standard contract documents, including specifications and bills of quantities. Responsibility on tendering and awarding of contracts, which initially was centered at headquarters, is being transferred gradually to the field offices.

Supervision

Each field office has between 4 and 7 inspectors or supervisors who are responsible for supervising the maintenance contracts. As previously noted, the field offices use individual work schedules to control the type, location, and extent of work to be performed. They also use these schedules to confirm that all work has been done and, where appropriate, to document actual quantities. As required by the Government, all work measurements are to be verified by an independent consultant. Initially, this role was performed by the international consultant. The responsibilities are gradually being transferred to local consultants, five individuals have been already retained.

Supervision is carried out by constant monitoring or through spot reviews, depending on the type and complexity of the work. The size of the supervision staff has gradually increased as the work load has increased. All work is assessed and measured when all items in individual work schedules are completed. Assistance and oversight of supervision is provided by consultants or engineers at the Headquarters level.

Payments are withheld for workmanship or materials that do not meet the specifications.
Payment Procedures and Auditing

Upon completion of individual work schedules, the work is measured jointly by the contractor, field office representative, and consultant. Actual quantities are recorded on a measurement form. All parties sign the document. A Certificate Summary is then prepared showing the sum total for each appropriate work item. All parties sign this document, as well. The consultants also prepare a monitoring report independently, which is forwarded separately to the accounts department of Headquarters. The Headquarters office checks the certificates for arithmetic errors. Payment will not be made if any discrepancies exist between the Certificate Summary and the consultant report.

The payment process, from measurement through issuance of the payment order, takes no more than 72 hours. However, actual payments are sometimes delayed for several weeks because funds are released in quarterly installments from the Ministry of Finance to NHA. In addition, all payments are made at headquarters, forcing the contractors to travel to Islamabad to receive their payment. Under the new organization, all funds will be released to NHA at the beginning of the year allowing financial management according to requirements. It is also envisaged that Regional Offices will be responsible for payment to contractors of each Region.

The Auditor General of Pakistan has authority to audit contract payments.

Transition from Force Account to Contract Maintenance

The decision to establish the contract maintenance program was made by the National Highway Board, based on a study performed on behalf of the World Bank. Since the Board assumed maintenance responsibilities that were previously held by the provincial governments, the agency had no maintenance forces, equipment, or facilities. This, along with a goal of performing high quality, low cost work, a desire to avoid diversion of funds to other activities, and an overall objective to enhance the contracting capacity, played significant roles in the decision to use contract maintenance.

A great deal of effort was undertaken to ensure success of the contract maintenance program. The international consultant was instrumental in developing the maintenance management system, specifications, contract documents, and contract supervision and payment procedures that are currently being used. In fact, the consultant was initially responsible for performing most functions that are now performed by the agency. Further, the consultant provided training to NHA employees in contract administration. With experience to supplement the training, many of the required skills have been gradually transferred to NHA employees.

The transition to contract maintenance was abrupt, but it created few problems at the national level. This probably reflects, in part, the success of the planning effort. In addition, the transition was eased because, when the NHB was created it had no people, equipment, or facilities to dispose of.
On the other hand, it probably had a significant impact on the provincial governments. First, these governments had to deal with redeploying workers and equipment that formerly performed maintenance work on the national highways. Second, they suffered the loss of a significant source of financing. Prior to the transition, the provincial governments received funds (based on the "yardstick" formula) to maintain the national highways. They were free to divert these funds to other programs. With adoption of the contract maintenance program, the provincial governments no longer received these funds. This second issue, in particular, has been a major concern to the provincial governments.

In conjunction with the consultant, the NHA took the following steps to support the development and enhancement of the construction industry:

(a) Provided on-the-job training.

(b) Restricted participation in routine maintenance contracts to local firms.

(c) Adopted nationally standard contract documents as well as contracting and payment procedures that stress simplicity. Many policies and procedures were enacted specifically to assist the contracting industry.

d) Encouraged plant investment by providing a long-term commitment to upgrade the national highway system. Although the budget for maintenance has been insufficient to cover real needs, its annually increasing level has demonstrated this commitment.

Assessment of Experience with Contract Maintenance

Overall, the NHA considers its contract maintenance program to be a success. Development of the MIL system and adoption of a comprehensive, uniform contract maintenance program that stresses simplicity have been most important to the outcome.

The performance guarantee, warranty, and retainage requirements have probably not constrained competition because they only apply to periodic maintenance contracts. Generally, small contractors are neither interested nor qualified to perform such work. Also, the cumbersome payment procedures and the occasional delays in payments because of problems with availability of funds from the Treasury do not appear to be detrimental to the program.

In fact, the contracting industry has demonstrated quite an interest in maintenance work. Typically four or five contracts compete for maintenance contracts. Competition is slightly higher for periodic maintenance works. The pool of contractors has increased tenfold, from about 65 in 1987 to about 640 in 1991.

Availability of equipment was initially a problem, but the situation is improving as established contractors grow in size. Equipment is not generally available for lease, but they can hire some from the provincial governments. Supply of spare parts has also been a problem,
but the contractors have applied ingenuity to keep older equipment in operational condition. There is a sufficient supply of skilled mechanics and repair facilities in the private sector.

IV. SUMMARY AND CONCLUSIONS

The NHA has implemented many sound procedures to improve the operation of its road and bridge maintenance program. However, a large maintenance backlog still exists. Further, maintenance budgets have not been adequate to compensate for the effects of inflation or the increases in traffic. These problems have been recognized and are being addressed with assistance from the World Bank.

The NHA develops its annual maintenance budget request using information gathered through a comprehensive maintenance management system that clearly defined needs and priorities. However, to date, use of this information has not led to significant increases in funding. Hopefully the ongoing reorganization of NHA will lead to ensure adequate budgetary allocations.

While the transition to contract maintenance was sudden, it was relatively free of problems at the national level. This is due, in part, to the fact the NHA had no labor forces, equipment, or facilities to dispose of. This is also a reflection of the great deal of effort that was made to plan for the transition.

The transition probably had a significant impact on the provincial governments, which had to deal with redeploying workers and equipment that were no longer needed because of the contract maintenance program. More importantly, they lost a significant source of financing. Prior to the transition, the provincial governments received funds to maintain the national highways, which could be diverted to other programs. This funding mechanism was discontinued with adoption of the contract maintenance program.

The present maintenance organization requires some fine-tuning. The heavy concentration at headquarters of responsibilities on contract award, supervision of works and payment to contractors should be gradually passed on to the four Regional Offices, as envisaged in the agreements with the Bank, and partially to the field offices. The close and detailed management of maintenance work execution by the field offices should be transferred to the contractors as they acquire sufficient experience.

The number of contractors capable of performing road maintenance work has increased dramatically since the contract maintenance program was initiated. This attests to the success of the many characteristics of the program that were developed with this goal in mind. However, efforts should be made to provide for equipment leasing facilities to further assist the development of the construction industry.
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Mohsin Shaikh - Member Technical of the National Highway Authority
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Raja Nowsherwan - Director Maintenance, World Bank Transport Project
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Mansoor A. Sirchey, Kampar International
ANNEX B

ASSESSMENT OF THE EXECUTION OF ROAD MAINTENANCE BY CONTRACT

IN SELECTED COUNTRIES

Background

Performance of cost-effective maintenance requires finding new ways of performing maintenance activities at the lowest acceptable cost. One approach is to contract maintenance work as an alternative to accomplishing maintenance programs solely with agency personnel and equipment (force account). Lack of well-trained and specialist staff, poor utilization of plant and equipment, and peak work loads are factors that have compelled maintenance managers to consider contracting out certain road maintenance activities. There is also a growing realization that the planning and control of maintenance work, and hence accountability in the use of scarce maintenance resources, may be enhanced when work is carried out under contract. Past studies by TRB and the Bank (McMullen 1986; Harral, Henriot, and Graziano 1986; and Cox 1987) suggest that maintenance by contract may be a technically viable and cost-effective alternative to force account work for a wide variety of periodic and routine road maintenance activities.

Study Objectives

The primary objective of the study is to identify the circumstances in which it may be appropriate for public road agencies to effect road maintenance, both periodic and routine (or preventive and corrective) by contract and to establish the procedures that would be necessary for planning, budgeting, tendering, and administering such work.

Specifically, the study will:

i) Review and evaluate the experience and approaches to contracting road maintenance in selected countries;

ii) Evaluate the advantages and disadvantages of contracting versus force account work for a variety of periodic and routine maintenance activities;

iii) Assess the comparative costs, benefits, and quality of maintenance work carried out by contract and force account;

iv) Identify and describe the various contractual forms and arrangements used for contracting road maintenance work;

v) Assess the planning, financing, supervision, and administration requirements, including related institutional arrangements for effective preparation and execution of maintenance work by contract; and

vi) Assess significant issues that must be faced in the transition from force account to contract maintenance.

vii) Prepare guidelines for planning, budgeting, tendering, supervising, and administering road maintenance by contract, including adjustments/changes to commonly-used contract documents and procedures, standards and specifications.
Scope of the Study and Definitions

The study will assess recent experiences with contracted road maintenance programs in several countries using the attached Survey form to record all pertinent information. The following definitions should be of help in completing the form:

1. **Routine Maintenance** - (including corrective works) comprising operations that normally are repeated one or more times a year, e.g., local repair of roadway, shoulders, and pavement (asphalt-surfaced and concrete), grading of unpaved surfaces and shoulders; regular maintenance of roadsides, drainage, bridges, traffic control devices and furniture, road cleaning, dust and vegetation control, snow and sand removal, and maintaining rest areas and safety appurtenances (typical annual costs range from less than US$300 a kilometer to more than US$5,000 a kilometer).

2. **Periodic Maintenance** - (including preventive works) normally comprising operations requiring repetition over longer than yearly cycles, such as regraveling an unpaved road, resurfacing an asphalt-surfaced road with a thin asphalt overlay (less than 4 cm), a surface treatment, or a seal coat, or replacement of isolated concrete slabs, continuous repair or undersealing of a concrete road, to preserve its structural integrity and ride quality (annual costs can vary from less than US$10,000 a kilometer to more than US$50,000 a kilometer).

3. **Pavement Strengthening** - consists of operations to incorporate substantial enhancements in the bearing capacity, service standard and life span of the original road. It consists mainly of overlays with more than 4 cm thickness.

4. **Rehabilitation and Reconstruction** - operations needed to bring badly deteriorated roads back to original standards:
   - rehabilitation is defined as partial reconstruction;
   - reconstruction is replacement or recycling of full existing pavement structure (including base and sub-base levels) plus restoration of drainage structures, as required.

5. **Preventive and Corrective Maintenance** - Routine and periodic maintenance and pavement strengthening are often grouped together under the concept of Preventive Maintenance. With timely execution of these interventions, a road life can be substantially extended. However, ultimately a road will require rehabilitation or reconstruction, which represent Remedial or Corrective Operations, often called Remedial or Corrective Maintenance.

6. **Force Account Maintenance** - work performed by the road agency's staff using agency-owned or rented equipment.

7. **Contract Maintenance** - work performed by individuals or firms in the private sector of the economy.

8. **In-house Supervision** - supervision of work performed by the road agency’s staff using agency-owned or rented equipment. This may apply to supervision of Force Account as well as contract maintenance.
Instructions:

The responsibility for completing the survey form should be given to a senior manager, preferably the chief of maintenance. This individual should distribute the different parts of the form to specialized staff, request timely and complete replies, monitor the quality and consistency of the replies received, and assume responsibility for the timely completion and (if requested) the remittance of the completed forms to the Bank. To provide more uniformity in reporting, please consider the definitions provided above (and elsewhere throughout the survey). If precise data is not available, please provide the best estimate (indicate by "EST" the estimated nature of the response). If reasonable estimates cannot be made, please write "NA" rather than leaving blank responses.

Road Maintenance Survey Form - Table of Contents

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SURVEY OF ROAD MAINTENANCE BY CONTRACT (1991)

I. ROAD NETWORK SIZE AND CONDITION

Please complete the table below, using the most recent available data, to describe the size and condition of your agency's road network. If possible, please use the definitions provided. Otherwise, describe any differences between the definitions used by your agency and those provided.

Definitions:

Paved Road Conditions:
- Good: Roads substantially free of defects and requiring only routine maintenance.
- Fair: Roads having significant defects requiring resealing, resurfacing, or strengthening.
- Poor: Roads with extensive defects and requiring immediate rehabilitation or reconstruction.

Surface Treatment: One or more applications of bituminous material and cover aggregate.

Gravel: An unpaved road surfaced with a granular aggregate including gravel, crushed stone, broken bricks, etc.

<table>
<thead>
<tr>
<th>Year</th>
<th>Condition (Km)</th>
<th>Total</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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<tr>
<td>- Paved</td>
<td></td>
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<tr>
<td>Surface Treatment</td>
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<tr>
<td>Asphalt Concrete</td>
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<td>Portland Cement Concrete</td>
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<tr>
<td>Other (Specify:-------)</td>
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</table>

| Passability (Km) |
|------------------|---|---|---|
| - Total | | | |
| All Weather | | | |
| Seasonal | | | |

TOTAL (Paved and Unpaved):
II. ROAD MAINTENANCE EXPENDITURES AND ACCOMPLISHMENTS

Please complete the table below, using the most recent available data, to describe your agency's maintenance expenditures for last year, budget for current and next years, and physical accomplishments. Please use the definitions given in the earlier section on implementation of the study, or describe any differences between them and the definitions used by your agency. Please include all maintenance expenditures irrespective of the source of funds (capital, recurrent, loans, etc.)

<table>
<thead>
<tr>
<th>[Local currency (millions)]</th>
<th>[Km. of roads]</th>
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<tbody>
<tr>
<td>Actual/Est. Expenditures</td>
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<tr>
<td>Current Year</td>
<td>Next Year</td>
</tr>
<tr>
<td>(19__)</td>
<td>(19__)</td>
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- Periodic Maintenance by Force Account
  - paved roads
  - gravel roads (unpaved)

- Periodic Maintenance by Contract
  - paved roads
  - gravel roads (unpaved)

Subtotal Periodic Maintenance

- Routine Maintenance by Force Account
  - paved roads
  - unpaved roads

- Routine Maintenance by Contract
  - paved roads
  - unpaved roads

Subtotal Routine Maintenance

SUB-TOTAL MAINTENANCE
(Routine & Periodic)

SUB-TOTAL CAPITAL
(New Construction, Reconstruction, Rehabilitation, Major Strengthening)

For the most recent data available, what percent of the maintenance budget was actually used?

periodic......%
routine......%
III. MAINTENANCE WORK ITEMS PERFORMED BY FORCE ACCOUNT AND BY CONTRACT

A. Are complete records available on detailed expenditures of different maintenance work items carried out, both by force account and contract? (Please place an X to indicate the appropriate response).

   Yes........ Partially......... No........

B. If records are available, please complete the tables on pages 4, 5, and 6, based on the availability of data as discussed below. To improve the uniformity in reporting, some useful definitions are also included. Please provide the information for each maintenance work item listed in the table. The requested data is divided into two categories: first, items related to routine maintenance and then those related to periodic maintenance.

IT IS NOT NECESSARY TO PROVIDE INFORMATION FOR EACH ITEM LISTED. REPORT DATA FOR THE ITEMS THAT MAKE UP A SIGNIFICANT PART OF THE OVERALL MAINTENANCE PROGRAM; ITEMS COMPRISING ABOUT 80 PERCENT OF THE MAINTENANCE BUDGET OR FOR WHICH INFORMATION/DATA ARE EASILY AVAILABLE.

USE ONE OF THE FOLLOWING APPROACHES, DEPENDING ON AVAILABILITY OF DATA.

1) Complete Records are Available: Please provide information about expenditures in columns 1 through 3, and provide information about quantities of work accomplished in columns 5 through 7.

2) Complete Information About Expenditures is Available, but Accurate Data for Quantities of Work Accomplished is Not: Please provide information about expenditures in columns 1, 2, and 3. In addition, please provide your best estimate of the percent of quantities of work performed by contract in column 8.

3) Only the Total Amount Expended per Work Item is Available: Please provide information about expenditures in column 1. Also, please provide your best estimate of the percent of expenditures performed by contract in column 4. In addition, please provide your best estimate of the percent of quantities of work performed by contract in column 8.

4) Only the Total Amount Expended for Maintenance by Force Account and By Contract is Available: Please register this information in the subtotal line of columns 2 and 3. Also, please provide your best estimate of the percent of expenditures performed by contract in column 4 for each maintenance work item.

Definitions:

- Patching and Repair of Asphalt Concrete Pavement --
  Superficial: Deterioration requiring remedial work of the surface layer only.
  Deep: Deterioration requiring repair to underlying pavement layer, including base or subbase.
- Resealing of Asphalt Concrete Roads: Treatment of a pavement with a thin coat of bituminous material and, usually, fine aggregate.
- Roadside Vegetation Clearing: Includes mowing of grass and clearing of shrubs and trees.
- Surface Treatment: One or more applications of bituminous material and cover aggregate.
Data on Maintenance Work Items performed by Force Account and by Contract
(Note: The section on Periodic Maintenance begins on the next page)

<table>
<thead>
<tr>
<th>WORK ITEM</th>
<th>Unit</th>
<th>Expenditures</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Force Account</td>
</tr>
<tr>
<td><strong>1</strong></td>
<td></td>
<td><strong>2</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>Routine Maintenance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Surface</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patching &amp; Repair of Asphalt Roads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Superficial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Deep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crack Sealing of Asphalt Roads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grading of Earth or Gravel Roads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Light (motorgrading)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Heavy (scarifying, reshaping, compaction)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel Patching</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Sealing of Portland Cement Concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patching of Portland Cement Concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor Repairs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spot Painting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drainage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning of Culverts</td>
<td>Unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ditch Cleaning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- By Hand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- With Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roadsides</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roadside Vegetation Clearing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- By Hand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- With Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Litter Pick-up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WORK ITEM</td>
<td>Expenditures</td>
<td>Quantities</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unit Total</td>
<td>Force Account</td>
<td>Contract (% of Total)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td></td>
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<td>5</td>
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<td>6</td>
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<td></td>
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<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Routine Maintenance**

**Traffic Services**
- Maintenance of Signs
- Maintenance of Traffic Signals
- Maintenance of Roadway Lighting
- Maintenance of Pavement Markings
- Maintenance of Guardrail

**Other**
- Snow and Ice Control
- Sand Removal
- Slide Removal
- Other (Please Describe):

**Subtotal**

**Periodic Maintenance**

**Road Surface**
- Regraveling of Roads
- Resealing of Asphalt Roads
- Surface Treatments
- Asphalt Overlays (less than 4 cm)
- Cobble-Stone Replacement
- Repairs of Shoulders
- Replacement of Portland Cement Concrete
### Expenditures Quantities

<table>
<thead>
<tr>
<th>WORK ITEM</th>
<th>Expenditures</th>
<th>Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>Force Account</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

### Bridges
- Repair of Bridge Decks
  - Patching of Portland Cement Concrete
  - Timber Replacement

### Drainage
- Repair of Culverts

### Other
(Please Describe):

---

Subtotal

---

TOTAL

### What items are included in the costs comparison?

<table>
<thead>
<tr>
<th></th>
<th>Contract</th>
<th>Force Account</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct labor</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Fringe benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment rental, fuel &amp; lubricants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment amortization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office and shop rental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please describe):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
IV. MAINTENANCE ADMINISTRATION ARRANGEMENTS

A. Organization

Please provide organizational charts of your highway agency and of your road maintenance organization at headquarters and in the field. The charts should be of sufficient detail to describe the organization down to the maintenance crew level. They should also describe maintenance groups that provide support functions, such as equipment repair or materials supply.

B. Planning and Programing

1) Who is responsible for road maintenance planning and programing?
   a) Position of individual? ........................................
   b) Relationship in organization? .................................

2) If your agency’s road network is classified into different categories, (such as primary, secondary, tertiary, etc.), please describe each classification and their corresponding lengths (in km)

C. Budgeting

1) Please mark the appropriate response with an X to indicate the procedures that your agency uses for budgeting?
   a) Estimation of physical maintenance requirements (based on performance standards and costs) ....
   b) Previous year budget, adjusted for inflation ....
   c) Previous year expenditures adjusted for inflation ....
   d) "Yardstick" method (specified amount per km by class of road) ....
   e) Other (please describe) ...........................

2) How is the budget allocated among regions, provinces, or districts?
V. SELECTION OF MAINTENANCE WORKS ITEMS TO BE CONTRACTED

A. Importance of Decision Making Factors

Please mark the appropriate responses with an X to indicate the relative importance of the following factors on your agency's decision to use contract maintenance:

<table>
<thead>
<tr>
<th>Factors:</th>
<th>Very Important</th>
<th>Important</th>
<th>Somewhat Important</th>
<th>Not a Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitation on Force Account staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor Management (desire to improve efficiency, reduce staffing, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need for specialized skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need for specialized equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate availability or poor utilization of force account equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desire to resolve logistics problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(equipment parts, materials, transportation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need to cover peak work loads</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of works</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need for quick response in emergency situations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to obtain services at lower cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desire to avoid diversion of funds to other activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desire to enhance contracting capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National or regional legislation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government or agency policy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement rules or requirements of financing organization (such as World Bank)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure from contractors or other groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other factors (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other factors (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### B. Selection Criteria

Please mark the appropriate responses with an X to indicate the relative importance of the following criteria on your agency's selection of work items to be contracted:

<table>
<thead>
<tr>
<th>Criteria:</th>
<th>Very Important</th>
<th>Important</th>
<th>Somewhat Important</th>
<th>Not a Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount, location, and concentration of work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to define and measure work to be performed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of time and resources to plan work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to inspect and control the work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of experienced and capable contractors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expectation that work can be performed at a lower cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expectation that improved reliability and quality of maintenance can be obtained</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other criteria (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other criteria (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### C. History of Agency's Efforts to Contract Maintenance

Please complete the following questions concerning your agency's efforts to initiate a contract maintenance program. If your agency has applicable experiences, please provide separate responses for routine as well as periodic maintenance.

1) Who was responsible for the decision to use contract maintenance?

2) This decision was based on (please mark applicable response with an X):
   - Objective evaluation of data ......
   - Subjective assessment of conditions ......
3) Who is the responsible for selecting the work items to be contracted?

4) In what year was contracted maintenance initiated?
   Periodic.............
   Routine.............

5) Please mark the appropriate responses with an X to indicate how the contract maintenance effort started?

<table>
<thead>
<tr>
<th></th>
<th>Periodic</th>
<th>Routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nationally</td>
<td>......</td>
<td>......</td>
</tr>
<tr>
<td>Regionally (as a pilot)</td>
<td>......</td>
<td>......</td>
</tr>
</tbody>
</table>
VI. FORMS AND ARRANGEMENTS USED FOR CONTRACT MAINTENANCE

A. Type of Maintenance Contract

1) Please mark the appropriate responses with an X to indicate your agency's use of the following types of periodic maintenance contracts:

<table>
<thead>
<tr>
<th>Type of Contract:</th>
<th>Very Often</th>
<th>Often</th>
<th>Seldom</th>
<th>Not Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lump sum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost plus fixed fee</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hourly (equipment or personnel)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please describe)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Please mark the appropriate responses with an X to indicate your agency's use of the following types of routine maintenance contracts:

<table>
<thead>
<tr>
<th>Type of Contract:</th>
<th>Very Often</th>
<th>Often</th>
<th>Seldom</th>
<th>Not Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lump sum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost plus fixed fee</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hourly (equipment or personnel)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (please describe)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Scope of Maintenance Contracts

Please mark the appropriate responses with an X to indicate the scopes of maintenance contracts that your agency has used:

1) All maintenance activities on a designated highway section?  Yes   No
2) All maintenance activities in a specific region or area?      Yes   No
3) A specific maintenance activity in a region or area?         Yes   No
4) A specialty maintenance activity at a specific location?     Yes   No
5) Supply of material, labor, or equipment?                     Yes   No
C. Contract Practices

Please provide sample contract documents for the types of contracts that are most often used for both periodic and routine maintenance. In addition, please provide the following general information:

1) Description of Work:

   a) Does your agency use the following items in contract documents as a means to describe the work to be performed:

<table>
<thead>
<tr>
<th>Specified?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Standards?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Other (please describe)?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   b) How does this information compare with instructions conveyed to force account maintenance crews?

   c) Does your agency use standard contract maintenance documents?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

   d) Is the work, including trigger values for when and where it is to be performed, and overall level of effort, clearly defined?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

   e) What penalties are invoked for workmanship or materials that does not meet the specifications or performance standards?

   f) Is a detailed estimate of work quantities provided?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

   g) Do the contracts reflect consideration to the following:

<table>
<thead>
<tr>
<th>Geographical location (concentration) of work?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of road section (standard sections)?</td>
</tr>
<tr>
<td>Similarity of work?</td>
</tr>
<tr>
<td>Cost?</td>
</tr>
</tbody>
</table>

   h) Please mark the appropriate responses with an X to indicate the typical duration of your agency's maintenance contracts?

<table>
<thead>
<tr>
<th>1 - 3 months</th>
<th>3 - 12 months</th>
<th>1 - 3 years</th>
</tr>
</thead>
</table>
f) Is the contractor allowed to use innovative techniques or equipment?  

<table>
<thead>
<tr>
<th></th>
<th>periodic</th>
<th>routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Quality of materials:

a) Are the acceptance criteria for materials clearly described?  

<table>
<thead>
<tr>
<th></th>
<th>periodic</th>
<th>routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Are standard or widely recognized test methods used?  

<table>
<thead>
<tr>
<th></th>
<th>periodic</th>
<th>routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c) Is the frequency of testing identified?  

<table>
<thead>
<tr>
<th></th>
<th>periodic</th>
<th>routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3) Payment Provisions:

a) Please mark the appropriate responses with an X to indicate the frequency of payment typically used by your agency?  

<table>
<thead>
<tr>
<th></th>
<th>periodic</th>
<th>routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quarterly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After completion of specific stages of work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Please mark the appropriate responses with an X to indicate the basis for payment typically used by your agency:

<table>
<thead>
<tr>
<th></th>
<th>periodic</th>
<th>routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimate of percentage of quantities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detailed measurements of quantities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4) Performance bond, guarantees, retainage, and warranties:

a) Is a performance bond needed?  

<table>
<thead>
<tr>
<th></th>
<th>periodic</th>
<th>routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
b) Is a performance guarantee needed? If so, what is the size of the
   guarantee?
   Periodic: ........................................................
   Routine: ........................................................

   c) Is a portion of the payments held in retainage? If so, how much?
   Periodic: ........................................................
   Routine: ........................................................

   d) Is a warranty period used?
      Yes
      No

D. Solicitation and Award of Contracts

1) Is open competition used? If not, please describe the restrictions on
   bidders ........................................................

2) Are contractor registration or prequalification requirements used? If
   so, please describe them ...............................................

3) Award of contracts:
   a) Please indicate (in weeks) the amounts of time that are typically
      required to perform the following:
         Agency preparation of bid documents through advertising
         Contractors' preparation of bids
         Agency bid evaluation through contract award
         Delay between contract award and work start-up

<table>
<thead>
<tr>
<th>Routine</th>
<th>Periodic</th>
<th>Emergency</th>
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b) Relationship to budget cycle:

- Does the award of maintenance contracts coincide with the start of the budget year?
  Yes ......
  No ......

- Can maintenance contracts be carried forward from one budget year to succeeding ones?
  Yes ......
  No ......

VII. SUPERVISION OF CONTRACT MAINTENANCE, PAYMENTS, AND AUDITS

A. Supervision of Contract Maintenance

1) Please mark the appropriate responses with an X to indicate who is responsible for supervision of contract maintenance work activities?
   Headquarters staff ......
   Field office staff ......
   local agencies ......
   consultants ......
   Other (please describe) ......

2) Please describe your agency's monitoring and oversight of contract maintenance supervision.

B. Payment Procedures

1) Briefly describe the procedures used to issue a progress payment to the contractor.

2) How much delay is typically encountered between presentation of bill and actual payment?

3) Are payments occasionally (or typically) delayed by constraints on the availability of funds?
   Yes....
   No.....
C. Audit Practices

1. Please describe the audit practices used by your agency to verify:
   a) Satisfactory completion of work (quantities and quality) .......... 
   ........................................................................ 
   ........................................................................
   b) Accuracy of payments ............................................ 
   ........................................................................
   ........................................................................

2. Discuss any audits that are performed by outside agencies? .......... 
   ........................................................................
   ........................................................................

D. Documentation

Please provide examples of forms and reports that concern supervision, 
payments, and audits of maintenance contracts.

VIII. TRANSITION TO CONTRACT MAINTENANCE

A. Highway Agency Organization and Function

1) Please describe how your agency instituted changes to the following 
   program areas to accommodate contract maintenance:
   a) Planning (improve ability to identify needs, establish 
      priorities, develop or improve performance standards) .......... 
      ........................................................................
   b) Budgeting process (reduce fluctuations, ensure availability of 
      funds) ................................................................
      ........................................................................
   c) Roles (contract administration and supervision vs. performance 
      of force account) .................................................. 
      ........................................................................
   d) Procedures that address:
      - Contract administration ...........................................
      ........................................................................
      - Supervision ........................................................
      ........................................................................
      - Training ............................................................
      ........................................................................

2) How did your agency accommodate large surpluses of:
   a) Personnel?
   b) Equipment?
   c) Material supplies and sources?
   d) Plants and facilities?

B. Assistance to Contracting Industry

1) Please describe your agency's efforts to establish or promote expansion of the contracting industry through the following:
   a) Training.
   b) Direct assistance:
      - Financial.
      - Equipment (sell, lease, etc.).
      - Materials (provide, sell, etc.).
      - Other.
   c) Demonstration of the agency's long-term commitment to the program.

2) Please describe your agency's efforts to increase the interest of the contracting industry in contract maintenance:
   a) Elimination of administrative restrictions or constraints.
   b) Increased advertising of contracts (including international contractors).
IX. ASSESSMENT OF EXPERIENCES WITH CONTRACT MAINTENANCE

A. Impacts of Financing and Budgeting

1) Have there been significant fluctuations in the overall maintenance budget?
   Yes........
   No........

2) Is any commitment made to ensure a relatively constant or increased amount of contract maintenance work will be available in the future?
   ........................................................................................................................................
   ........................................................................................................................................

B. Time Requirements

1) Time requirements for developing and executing maintenance contracts:
   a) Can they be executed quickly enough to allow work to be performed when it is needed and within a short period after the estimate of work quantities is prepared?
      Yes .......
      No .......
   b) Do the time requirements for preparation of bid documents through advertising, and coordination with your agency's budget cycle, constrain the use of contract maintenance?
      Yes .......
      No .......

2) Is sufficient time provided before work must begin to allow the contractor to plan and schedule the effort in an efficient manner?
   Yes........
   No........

C. Impacts of Performance Bond, Guarantee, Warranty, and Retainage Requirements

Please discuss how your agency's performance bond, guarantee, retainage, and warranty requirements may be precluding potential contractors from submitting bids. ........................................................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................

D. Availability of Contractors

1) Overall, have contractors shown an interest in performing contract maintenance?
   Yes
   No

<table>
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<tr>
<th>periodic</th>
<th>routine</th>
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<td>......</td>
<td>......</td>
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</table>
2) What is the number of bids typically received in response to contract maintenance advertisements?
   periodic ......
   routine ......

3) Do these contractors have sufficient resources and capabilities to perform the work?
   Yes......
   No......

4) Is the pool of contractors increasing? If so, by how much?..........
   ......................................................................................

5) Describe any regulations or procedures or practices that have been used to encourage increased participation by the private sector..........
   ......................................................................................

6) Describe any regulations, procedures, or practices that may discourage participation by the private sector....................................
   ......................................................................................

E. Equipment Availability and Constraints

1) Discuss equipment availability:
   a) Owned by contractors..........................................................
   ......................................................................................
   b) Available for lease by contractors..........................................
   ......................................................................................
   c) Agency lease to contractors................................................
   ......................................................................................

2) Discuss equipment constraints:
   a) Lack of replacement parts..................................................
   ......................................................................................
   b) Lack of repair facilities......................................................
   ......................................................................................
   c) Lack of skilled mechanics..................................................
   ......................................................................................
F. Overall Experiences

1) Describe any problems you have experienced with contractors’ quality of work and how you resolved them: ..............................................................
........................................................................................................
........................................................................................................

2) Describe your agency’s experiences with the use of warranties to ensure work quality for a period of time following contract completion? ........
........................................................................................................
........................................................................................................

3) Describe any problems that contract maintenance has caused with in-house employees and how your agency has resolved them: ............
........................................................................................................
........................................................................................................

4) Are sufficient resources committed to supervision of contract maintenance?
   Yes......
   No......

5) Describe the experiences with the use of private consultants in supervisory roles: .................................................................
........................................................................................................
........................................................................................................

6) Discuss your agency’s experience in reducing the overall number of Force Account maintenance employees as a result of the use of contract maintenance: ............................................................
........................................................................................................
........................................................................................................

7) Discuss your agency’s experience in reducing the number of employees involved with maintenance supervision as a result of the use of contract maintenance: ............................................................
........................................................................................................
........................................................................................................

G. Level of Satisfaction with Contract Maintenance

NOTE: To be completed by high level manager, preferably the chief of maintenance.

Please mark the appropriate response with an X to indicate your level of satisfaction with contract maintenance:

Major problems ......
Few problems ......
Satisfied ......
Favorable ......
Highly favorable ......
MAINTENANCE ADMINISTRATION ARRANGEMENTS
(Supplement to Section IV)

A. Planning and Programming

1. Please mark the appropriate lines with an X to describe the maintenance planning and programing information that is available for each classification of road (as identified in survey item IV.B.2):

   Road Classification: _____ _____ _____

   a) Detailed physical inventory, obtained by:
      - field surveys, updated every ____ years
      - updating historical records
      - estimation

   b) Road condition evaluation every ____ years by:
      - objective assessment based on measurement of roughness or condition (PSI, IRI, PCI, etc.)
      - objective rating based on defined sufficiency criteria
      - visual survey

   c) Traffic information updated every ____ years, obtained by:
      - a comprehensive system of traffic counts
      - random surveys at specific stations
      - estimation

   d) Unit cost information on maintenance works
      - reliable information available for all work items
      - reliable information available for some work items
      - this information updated ____ times a year or every ____ years

2) Please mark the appropriate lines with an X to indicate how your agency uses this maintenance planning and programing information:

   a) To establish priorities and program maintenance activities
   b) To establish uniform maintenance standards
   c) As inputs into a computerized maintenance management system
   d) As inputs into the World Bank's Highway Design and Maintenance (HDM) model, or an equivalent tool
   e) For a subjective assessment of maintenance needs (the "yardstick" method)
B) **Budgeting**

1) Who is responsible for budgeting for maintenance?
   a) Position of individual? .............................................
   b) What is the individual's relationship to the Director of Maintenance? .............................................

2) Please mark the appropriate response with an X to indicate the type of budget that your agency uses?
   a) Lump sum ......
   b) Object of expenditure ......
   c) Performance based ......

3) Is contract maintenance budgeted separately from force account maintenance?
   Yes.....
   No.....

4) If the answer is yes, please explain the reasons for this decision:
   ........................................................................
   ........................................................................

C. **Financing**

Discuss the impacts that financing has on the maintenance program:

1) How does available financing compare with inflation over the years? .............................................
   ........................................................................
   ........................................................................

2) How does available financing compare with increasing requirements?
   ........................................................................
   ........................................................................
   ........................................................................

**SELECTION OF MAINTENANCE WORKS ITEMS TO BE CONTRACTED**

(Supplement to Section V.C)

**History of Agency's Efforts to Contract Maintenance**

1) Which were the first work items to be contracted?
   Periodic..............................................................
   Routine..............................................................
2) Please list (in the order they were added) other maintenance work items that were subsequently contracted:

Periodic

Routine

3) Please mark the appropriate responses with an X to indicate the changes in the overall amount of maintenance work that has been performed by contract over the years:

<table>
<thead>
<tr>
<th>Periodic</th>
<th>Routine</th>
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<tbody>
<tr>
<td>Substantially increased</td>
<td>......</td>
</tr>
<tr>
<td>Increased</td>
<td>......</td>
</tr>
<tr>
<td>Remained steady</td>
<td>......</td>
</tr>
<tr>
<td>Decreased</td>
<td>......</td>
</tr>
<tr>
<td>Substantially decreased</td>
<td>......</td>
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</table>

**Forms and Arrangements Used for Contract Maintenance**

*(Supplement to Section VI.D)*

**Solicitation and Award of Contracts**

1) Describe your agency's experiences in obtaining maintenance bids from:
   a) Contractors that typically seek work in a limited area or region...

   b) Contractors that seek work throughout the nation...

   c) Contractors that are based outside the country...

2) Solicitation of bids:
   Describe the methods your agency uses to inform potential bidders of the availability of maintenance contracts...