Improving Highways Maintenance
A Management Handbook

The Audit Commission for Local Authorities in England and Wales
Improving Highways Maintenance
A Management Handbook

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  *Improving Highways Agency Arrangements Between Counties and Districts*
Introduction

1. County councils, metropolitan districts and London boroughs are the highway authorities for all roads in England and Wales other than trunk roads and motorways, which are the responsibility of the Department of Transport (DTp) or the Welsh Office. District councils may act as agents to counties, and about two thirds do so. Councils in England and Wales spend about £1,150 million a year on maintenance and £580 million on capital works on their own roads.

2. Since 1976 traffic using the road network maintained by local authorities in England and Wales increased by more than 20 per cent, while money spent on road maintenance declined in real terms by five per cent (10 per cent per kilometre). The effect of this is illustrated by the National Road Maintenance Condition Survey (NRMCS) which over the last six years has shown a deteriorating trend in the condition of all classes of roads maintained by local authorities. Over the same period of time, central government invested heavily in new motorways and in maintaining existing motorways and trunk roads. A recent survey* estimates that 20 per cent of 54,000 mainly pre 1922 road bridges under 50 metres span need urgent attention. The Audit Commission estimates that about £600 million in total may have to be spent on bridge strengthening by local authorities.

3. Against this background, the Audit Commission has carried out a study of highways maintenance to identify the major issues and how they might be tackled. This study shows that urgent and positive action by both central and local government is required. It reveals that in the short term it is necessary for central government to maintain the recent increases in the Public Expenditure Survey provision for highways maintenance, and for local authorities to spend up to that provision, which will be achieved if authorities in aggregate spend close to their Grant Related Expenditure Assessment (GRE). This level of funding is necessary to overcome the shortfall in expenditure on structural maintenance over the last 10 years and to halt the decline in the condition of the road network. These issues are dealt with in Chapter 1 of this report which describes the national scene.

4. In the longer term, however, local authorities must improve the efficiency and effectiveness of maintenance especially routine activities such as sweeping and grass cutting, to free funds for structural maintenance. To achieve these improvements requires a more ordered and methodical approach, particularly in the following areas:

- *Adopting explicit authority-wide policies on standards, frequencies and priorities based on the Local Authority Associations' Code of Good Practice or the Department of Transport's Code.* The study shows that about half the highway authorities do not use these guidelines and many have not reviewed their policies for years, particularly for routine maintenance.

* The Assessment of Highway Bridges and Structures - Bridge Census and Sample Survey, DTp, January 1987
- **Adopting budget allocation procedures based on assessments of need** rather than historic allocations. The study shows that few highway authorities have attempted to base routine maintenance budgets on need and that many do not use any formal assessment methods for structural maintenance activities. More accurate and up to date inventories of the highway network and what is on it (number of street lights, gullies, etc) are required. The study shows that up to 25 per cent of authorities do not have even an estimated inventory for specific routine maintenance activities.

- **Improving county — district agency arrangements.** The county council is the highway authority and must manage the activity. The agent must apply county policy within the discretion allowed.

- **Applying more effective control,** particularly in the day to day management of routine maintenance. The study shows that if authorities could reduce their unit costs to those achieved by the best 25 per cent some £90 million a year could be released from routine maintenance for spending on structural maintenance. More significantly, with the introduction of the Local Government Act 1988 and increased competition from the private sector, authorities' DLOs may well have to reduce their unit costs to those of the best 10 per cent to stand a chance of winning the work in open competition. This will require reviewing and tightening up many of the existing performance-related bonus schemes.

- **Improving the efficiency of winter maintenance operations.** The study shows that properly calibrated spreading equipment could itself reduce the cost of salt used by at least £15 million annually.

These subjects are covered in detail in Chapter 2.

5. All funds spent on structural maintenance must be spent effectively and efficiently. To do this many authorities have to improve their management arrangements by:

- Developing computerised highway management systems incorporating inventories, historic treatment data, budget preparation and network condition data.

- Ensuring a clean client/contractor organisational split.

- Improving contract performance monitoring, site supervision and materials testing regimes to ensure that they are getting what they are paying for.

All of these topics are dealt with in Chapter 3.

6. The research for this report was based on in-depth investigations at 44 authorities listed in Appendix 1, plus a detailed questionnaire completed by over three quarters of all highway authorities. The Commission's auditors have already carried out work in authorities throughout the country on the routine maintenance activities. In 1988, they will be examining structural maintenance, winter maintenance, agency arrangements and overall management of highways maintenance. Chapter 4 on appropriate management arrangements pulls all this together and Chapter 5 outlines the next steps that need to be taken by central and local government to establish a sound road network within reasonable resources.

7. This report is a companion volume to the shorter report entitled *Improving the Condition of Local Authority Roads — The National Picture.* It concentrates on the improvements that can be implemented locally and is aimed primarily at highways engineers and other chief officers.
1. The National Position

8. There are 300,000 kilometres of public road in England and Wales. The Department of Transport (DTp) and the Welsh Office are responsible for maintaining the motorways and trunk roads totalling 12,100 kilometres. All other roads are the direct responsibility of local authorities. Metropolitan districts and London boroughs discharge their responsibility directly; county councils do so directly or by awarding agency to district councils on all or some of the roads in that district’s area. The DTp and the Welsh Office discharge their responsibilities on motorways and trunk roads by awarding agencies to county councils, metropolitan districts, London boroughs and, recently, on some sections of motorways, to private sector consultants. Table 1 shows how the public road network is divided amongst the different highway authorities (excluding special highway, bridge and tunnel authorities who are responsible for short but important highway links).

<table>
<thead>
<tr>
<th>Road Class</th>
<th>Country</th>
<th>Highway Authority</th>
<th>Number</th>
<th>Road Length km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorway and Trunk</td>
<td>England</td>
<td>Dept. of Transport</td>
<td>1</td>
<td>10,353</td>
</tr>
<tr>
<td></td>
<td>Wales</td>
<td>Welsh Office</td>
<td>1</td>
<td>1,775</td>
</tr>
<tr>
<td>All Others</td>
<td>England</td>
<td>Counties</td>
<td>39</td>
<td>208,601</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Met. Districts</td>
<td>36</td>
<td>35,377</td>
</tr>
<tr>
<td></td>
<td></td>
<td>London Boroughs</td>
<td>33</td>
<td>12,654</td>
</tr>
<tr>
<td></td>
<td>Wales</td>
<td>Counties</td>
<td>8</td>
<td>30,895</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>299,655</td>
</tr>
</tbody>
</table>

Source: DTp Statistics Bulletin 87(32)

9. The length of public road has increased by 7.5 per cent over the last twenty years, averaging a growth of 0.4 per cent a year. The motorway network has grown at the greatest rate (Exhibit 1).

10. In the past 20 years the volume of traffic has increased by 92 per cent (Exhibit 2). Within this figure, there is an increase of 25 per cent in use by goods vehicles, concentrated on trunk roads. This is particularly important in maintenance terms because of the far greater damage caused by heavy vehicles.

11. The highway network is increasingly used as a conduit for public services, particularly in urban areas. The number of road openings by utilities in 1982–83 is shown in Table 2. The Home Report into the Public Utilities Street Works Act 1950* made recommendations on improving the arrangements for digging up roads, but, despite setting up a working party, the government has yet to act on the findings.

* Review of the Public Utilities Street Works Act 1950, HMSO 1985
ROAD LENGTHS IN ENGLAND AND WALES

Total road length has been increasing at about 0.4% a year with a much higher rate of growth for motorways.

Exhibit 1

THE GROWTH IN TRAFFIC 1966-1986 - GREAT BRITAIN

Traffic has increased by 92% over the period 1966 to 1986.

Exhibit 2

Source: Audit Commission analysis of DTp data
TABLE 2: PUBLIC UTILITY ACTIVITY

<table>
<thead>
<tr>
<th>Service</th>
<th>New and Replacement Mains kms</th>
<th>New and Replacement Services No.</th>
<th>Small Openings No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>4,000</td>
<td>200,000</td>
<td>217,000</td>
</tr>
<tr>
<td>Gas</td>
<td>5,457</td>
<td>767,000</td>
<td>544,000</td>
</tr>
<tr>
<td>Telecom</td>
<td>3,150</td>
<td>467,000</td>
<td>74,000</td>
</tr>
<tr>
<td>Water</td>
<td>3,200</td>
<td>230,000</td>
<td>536,000</td>
</tr>
<tr>
<td>Sewers</td>
<td>2,500</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18,307</strong></td>
<td><strong>1,664,000</strong></td>
<td><strong>1,371,000</strong></td>
</tr>
</tbody>
</table>

Source: National Joint Utilities Group 1982-83

EXPENDITURE

12. In 1986-87 the cost to the DTp and Welsh Office of maintaining the motorway and trunk road network was £348 million, while local authorities spent £1,150 million on all the other classes of road. From 1978-79 to 1986-87 real terms expenditure per kilometre on motorways and trunk roads in England increased by over 60 per cent while on local authority maintained roads it declined by 10 per cent (Exhibit 3).

INDICES OF MAINTENANCE EXPENDITURE PER KM OF ROAD - ENGLAND

While central government has significantly increased maintenance expenditure on motorways and trunk roads, local authority expenditure has declined

Source: Audit Commission analysis of figures from DTp

Exhibit 3
13. This disparity partly reflects the increasing importance of motorway traffic and the growth of heavy goods vehicle traffic on the motorway and trunk road network. It also reflects the DTp’s efforts to eliminate the backlog of maintenance identified by the National Audit Office in its 1985 report Department of Transport: Expenditure on Motorways and Trunk Roads. Broadly speaking, the current work plan is to renew 80 miles of motorway a year, of which 70 miles is to keep pace with deterioration and 10 miles to reduce the total maintenance backlog of about 50 miles. For trunk roads the DTp estimates that 170–180 miles of carriageway should be renewed each year to keep abreast of deterioration. At the current rate of progress, the backlog of maintenance is expected to be cleared by 1992. According to the Welsh Office, there is no significant backlog of maintenance on motorways and trunk roads in Wales. This attack by central government on the backlog of motorway and trunk road maintenance contrasts with the position on local authority roads where the backlog is increasing.

14. Central government progressively reduced its provision for local authority highways maintenance between 1975-76 and 1981-82. However, over the last two financial years it has increased the provision by 15 per cent and 13 per cent respectively (Exhibit 4). Not all authorities spend their allocation on highways. Some choose to divert the funds to other services, as they are entitled to do. This may be because local authorities find it difficult to raise spending quickly due to the effects of government controls on local expenditure or because they are reluctant to take harsh political decisions about service levels.

**COMPARISON OF PROVISION WITH OUTTURND FOR MAINTENANCE IN ENGLAND**

English authorities are now under-spending provision

![Graph showing comparison of provision with outturn for maintenance in England](image)

Budgetted outturn for 1987-8 shows a projected underspend of £143 million

*Source: Audit Commission analysis of data from DTp*
ROAD CONDITION

15. Road condition is influenced by a number of factors. Initial design, traffic use, weather and ground conditions are some of the more significant. All roads constructed in the last 50 or so years have had to meet established design criteria, and in recent years the design process has become more sophisticated with careful estimation of future traffic loads and bearing capacity of alternative road structures. However, these roads are only a small part of the national road network. Many roads have had little formal design, rather they have been built up over the years with successive layers of treatments. The process of failure in these undesigned roads can be very rapid if their foundations are disturbed by excavation or bad weather.

16. Traffic use affects both the surface and the structure of roads. All vehicles polish and wear the road surface, leading to lowered skid resistance and accelerated ageing. Heavier vehicles cause stress to the road structure leading ultimately to foundation cracking and failure. It has been shown that on flexible (i.e. ‘black top’) roads the damaging power of an axle is related to the fourth power of its weight (Exhibit 5) and, in locations close to bridge abutments and viaduct joints, the damaging effects may be up to the sixth power of axle weight. The Comptroller and Auditor General reported to the House of Commons in 1987 that heavy lorries cause wear to roads and bridges which costs public funds over £600 million per year, though some of this cost could be offset by improved suspension design. Not the least worrying aspect of the heavy lorry problem is the effect of widespread overloading. Work by the University of Newcastle indicates that bad load

COMPARISON OF THE EFFECTS OF THREE TYPICAL 38 TONNE LORRIES

The damaging power of an axle is related to its loaded weight

Source: National Audit Office report "Department of Transport: Regulation of Heavy Lorries" 1987

Exhibit 5
distribution and straightforward overloading are likely to be the norm rather than the exception. Present highway design criteria take no account of overloading when calculating design life. Conventional analysis of the impact on roads of increased volumes of goods traffic is therefore likely to underestimate the probable wear and tear.

17. Weather and ground condition both affect road condition. A hard freezing/thawing cycle can break up a perished or cracked road surface and cause total foundation failure if it reaches the subsoil beneath. Similarly, water ingress through cracked surfaces, which cannot be drained because of sub-drainage failure, can lead to major road damage. The emphasis must be upon sealing roads to prevent these conditions.

18. Before 1970, assessment of the condition of the network was primarily a matter of professional judgement supported by such local information on residual life and expenditure as was available. Inevitably, there was no consistency of approach between (or within) authorities so there was no national trend information to support national investment decisions. The Marshall* report recommended formal condition measurement and the first steps were taken, in 1974, with the development by a group of local authorities of a systematic method of assessing condition called MARCH (Maintenance Assessment Ratings and Costings of Highways). This system was followed, in 1976, by another called CHART (Computerised Highway Assessment of Ratings and Treatment) which was developed by the TRRL (Transport and Road Research Laboratory). Both systems have similar objectives but involve different data collection methods.

19. The National Road Maintenance Condition Survey (NRMCS) was launched by the DTp and local authorities in 1977, with the aim of developing year on year information about road condition as a means of ultimately relating investment to need. Highway authorities carry out the fieldwork for the survey at specified sample sites using CHART and, on certain roads, deflectographs.

20. The NRMCS provides two types of information — (i) a defects index measurement for all roads and (ii) a residual life assessment for main roads. The defects index reveals that the condition of all roads (considered together) is deteriorating and that the 1986 figure is about nine per cent higher than that for 1977 (Exhibit 6). An analysis of the defects index by road class shows that similar trends are present for each class with particularly rapid deterioration of urban principal, urban unclassified and rural unclassified roads. Rural unclassified roads are 30 per cent worse than in 1977. The recently published 1987 NRMCS results show defect levels similar to those for 1986. There has also been a more recent decline in the condition of trunk roads to the point where the 1985 condition was 24 per cent worse than 1977.

21. The defects index for local authority roads has been increasing by about four per cent a year since 1980, implying that about four per cent more of the whole road network needs to be treated each year than is currently being treated (i.e. about 13 per cent rather than the current 9 per cent).

22. There is considerable public dissatisfaction with the current standard of highways maintenance, including the work of public utilities. The Commission commissioned a public opinion poll from MORI on attitudes to various local authority services in 1986 (Exhibit 7). The highways service figured badly in public esteem. Some of this dissatisfaction may be caused by public utility excavations which are mistaken for highway authority work, but the message is clear: the public is looking for improvement. A lane rental approach for at least the major excavations could speed up public utility works.

*Report of the Committee on Highway Maintenance, HMSO, 1970
DEFECTS INDICES FOR DIFFERENT TYPES OF LOCAL AUTHORITY ROADS

The condition of all roads is deteriorating

THE PROBLEM

23. There is an implied need for strengthening of urban principal roads of around four per cent of the network each year. The amount actually strengthened is between one and 1.5 per cent each year. The corresponding figures for rural principal roads are 1.5 per cent needed and one per cent achieved. The Institution of Civil Engineers has recently prepared a paper The state of roads and bridges in the U.K., which comments that the backlog of maintenance on local roads is huge. According to the Association of Municipal Engineers, at the current rate of road strengthening by overlays or resurfacing it will be
100 years before all roads are treated. In the case of many minor rural roads the only maintenance carried out may be routine maintenance, patching and a surface dressing every 20 to 30 years. According to the NRMCS, about 20 per cent of urban principal roads and 10 per cent of rural principal roads have a residual life of less than five years.

24. The national picture is of an expanding road network carrying increasing traffic and suffering major public utility activity but with declining maintenance expenditure leading to deteriorating road condition.

UNDERLYING CAUSES

25. What are the fundamental causes of this unsatisfactory state of affairs? Inadequate spending must be the most important factor. The Commission has also identified a tendency for some authorities to protect spending on routine maintenance to the detriment of structural maintenance, which leads to poor allocation of funds between routine and structural maintenance, insufficient competition for work with resulting high unit costs, and a lack of effective supervision and monitoring of performance. In the companion report on the national picture, the Commission estimates that an additional £200 million a year needs to be spent on structural maintenance to halt the decline in condition. This would not restore the network to the 1977 levels but would simply hold it at its present condition. The selection of 1977 is, in any case, quite arbitrary and does not represent a target level of condition. It could be higher or lower than what is considered desirable and achievable.

26. The money which authorities spend is not always being allocated to the right types of maintenance, or to the right roads. A disproportionate amount of money is sometimes spent on routine as opposed to structural maintenance and funds are spent on stop gap

PUBLIC ATTITUDES TO LOCAL AUTHORITY SERVICES

Street cleansing and road maintenance are the services with which the public are most dissatisfied

<table>
<thead>
<tr>
<th>Service</th>
<th>Satisfied %</th>
<th>Dissatisfied %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire</td>
<td>82</td>
<td>1</td>
</tr>
<tr>
<td>Libraries</td>
<td>78</td>
<td>5</td>
</tr>
<tr>
<td>Police</td>
<td>77</td>
<td>12</td>
</tr>
<tr>
<td>Refuse collection</td>
<td>85</td>
<td>13</td>
</tr>
<tr>
<td>Street lighting</td>
<td>80</td>
<td>14</td>
</tr>
<tr>
<td>Secondary schools</td>
<td>34</td>
<td>19</td>
</tr>
<tr>
<td>Footpath/street cleansing</td>
<td>44</td>
<td>50</td>
</tr>
<tr>
<td>Road maintenance</td>
<td>29</td>
<td>63</td>
</tr>
</tbody>
</table>

Source: MORI poll for the Audit Commission, May 1986
Figures do not necessarily add to 100% because not all people expressed an opinion

Exhibit 7
structural maintenance activities instead of the more fundamental and costly structural repairs. The systems used to allocate funds do not always ensure that they are spent in the right places, at the right time or on the right treatments. Few highway authorities have assessment systems that enable them to take need into account when settling inter-service budgets. Instead, they maintain historic spending patterns that may no longer be relevant. The effectiveness of highways maintenance is therefore suffering.

27. Unit costs also vary widely (Exhibit 8), partly because of the lack of effective competition in large areas of highways maintenance, inadequate supervision and slack DLO bonus schemes.

28. Another weakness of most highways maintenance operations is that there is no end of year comparison of work done against work planned. Spending against budget is monitored but there is no checking of what has been achieved for the money. Failure to monitor achievement of the programme can mask what are actually high unit costs, inefficient working practices and low productivity.

29. Problems in managing highways maintenance in counties are exacerbated by the way highways agencies are currently run. These agency arrangements are often difficult to operate and are a source of disputes. The problem is simple. The district councils wish to exercise more independence and so be less accountable to the highways authority than is acceptable to the county. To this central issue must be added other factors, including rivalries between officers and within the engineering profession, the desire to protect jobs in DLOs, and disputes over planning.

30. These agency problems are discussed in more detail in the Commission's interim publication *Improving Highways Agency Arrangements Between Counties and Districts* (HMSO, September 1987). Their overall effect is to blur accountability and responsibility and create management weaknesses. Significant time is lost in fractious disputes between county and district and agency arrangements have meant that budgets are allocated historically rather than according to a proper assessment of need. The existence of agents has diverted counties’ attention from their own deficiencies, while many budget allocation processes give districts little incentive to improve their own efficiency. Agency problems thus help create and maintain the waste and inefficiency discussed earlier in this chapter.

31. Full discussions of these problems are contained in the following chapters on routine and winter maintenance, structural maintenance and appropriate management arrangements. The last chapter “What Needs to be Done” summarises the Commission’s view of the key actions local and central government need to take.
THE RANGE IN PRICES PAID BY AUTHORITIES FOR THE SAME JOBS

For structural maintenance jobs, the range between the lower and upper quartiles is typically about 1.3 to 1

Source: Audit Commission highways models priced by authorities
For routine maintenance jobs, the range between the lower and upper quartiles is typically about 1.6 to 1.
2. Efficient Routine and Winter Maintenance

32. Routine and winter maintenance together cost about £480 million a year (Exhibit 9). Routine maintenance has usually not received much attention from highways engineers. It therefore offers great opportunities for achieving more effective use of resources.

THE MAKE-UP OF THE HIGHWAYS MAINTENANCE EXPENDITURE FOR LOCAL AUTHORITIES IN ENGLAND AND WALES, 1986-7

Routine maintenance accounts for about one third of the expenditure

ROUTINE MAINTENANCE

33. Routine maintenance is here defined as:
- street lighting maintenance and energy costs;
- sweeping;
- grass cutting;
- gully emptying;

Source: Questionnaire data sent to all highway authorities: information from DTp and Welsh office
- maintenance of signs;
- signals;
- road markings and studs.

These can be thought of as the 'housekeeping' duties. They cost local authorities about £380 million a year. Much of the work is cyclical and can be planned and programmed in advance. Some of the work is reactive — dealing with traffic signals which have failed or street lights which have gone out. But an efficient and well run routine maintenance operation will take account of previous years’ demand for reactive maintenance in compiling budgets (Exhibit 10). The authority must first decide upon the services it wishes to provide, set budgets accordingly, arrange for the work to be performed either by a DLO or contractor, check to ensure that it is paying competitive prices, supervise the work properly and monitor overall performance.

**BUDGET SETTING AND PERFORMANCE MONITORING CYCLE FOR ROUTINE MAINTENANCE**

Authorities need to define policy on frequencies, collect inventory data and monitor performance to provide feedback.

Exhibit 10

34. Many authorities do manage some of their activities in this way but it is rare to find one managing all routine maintenance activities with equal thoroughness. So there are major opportunities for improvements. Because some authorities have no clearly defined policies and do not know what they are trying to achieve, they are over-providing services, paying too much for work, cannot be certain that the work they pay for has been carried out adequately (or at all) — and do not know what they are achieving for the money they spend. Better specification of services, full inventories, improved budgeting, supervision and monitoring, and more competitive tendering are needed to secure value
for money. With the implementation of the Local Government Act 1988, many routine maintenance activities which are currently outside the scope of the Local Government, Planning and Land Act 1980 will have to be put to competition. Each of these problems and opportunities for improvement are discussed below.

POLICY

35. Authorities must define what they are trying to do. This requires clear statements of policy on standards, service levels and specifications. For example, the authority will need to specify how many times a year grass should be cut. It will need to decide whether, at no cost to the owners, it should look after trees and hedges which it does not own but which abut the highway, or whether landowners should bear the costs implied by their legal responsibility for such trees and hedges. Exhibit 11 is an extract from a model policy document.

36. Once the policy has been established it should be adhered to by the highway authority’s own divisional or area engineers and surveyors, and, where applicable, by any district councils which the highway authority has appointed as an agent.

37. The cyclical nature of much routine maintenance means that it can be easily specified in advance. Specifications can also be provided for reactive maintenance — for example, a specified response time for the attendance of an engineer at a set of faulty traffic lights. The Local Authority Associations published in 1983 Highway Maintenance: A Code of Good Practice. This recommended frequencies and service levels for many cyclical activities. The LAA Code is currently being updated. The DTp has also issued standards for its motorways and trunk roads in the publications Code of Practice for Routine Maintenance and Trunk Roads and Trunk Road Motorways: Maintenance of Road Lighting.

USE OF THE LAA CODE

38. About half the counties surveyed by the Commission had standards at, or close to, those in the LAA Code but there are divergences well above, and sometimes below (Exhibit 12). Some of these are very marked — emptying gullies four times a year against a Code specification of two for example, while in summer many authorities scout street lighting for outages more frequently than is recommended. More than three quarters of highway authorities have now set standards and policies or have modified existing ones to take account of the LAA Code. A few authorities still lack formal specifications and rely upon their own engineers and, in counties, agent authorities to provide whatever service levels they see fit. In other cases, engineers or agents are not aware of, or are not applying, the authority’s standards. As a result, there are wide differences both in the standards applied by different authorities and in the services provided within an individual authority’s area.

39. In all three types of highway authority, deviations from the Code are biased towards higher frequencies suggesting a tendency to over-provide services. This contributes to the overspend on routine maintenance relative to structural work discussed elsewhere in this report. It is one area where individual authorities can readily revise their practices. Case Study 1 shows the scale of the opportunities from reduction in frequency that exist in some authorities.

40. There remains an unhelpful overlap in county areas between the counties’ duty to cleanse highways regularly enough to ensure safety of traffic and the districts’ duty to
OVERALL OBJECTIVES
To maintain the public highways for the safe and efficient movement of people and goods.
To ensure that the appearance of the highways is compatible with the local environment.

URBAN GRASS CUTTING OBJECTIVE
To maintain safety, to prevent the obstruction of sight lines and traffic signs, to inhibit the growth of weeds and to maintain a tidy appearance.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision splays, traffic islands, raised roundabouts, adjoining highways in built-up areas with numerous accesses</td>
<td>Cut all grass a maximum 5 times per year</td>
</tr>
<tr>
<td>Grass areas adjoining highways on all other roads</td>
<td>Cut 2 swathe widths a maximum 5 times per year</td>
</tr>
<tr>
<td>Grass areas adjoining footways and cycle tracks</td>
<td>Cut a single swathe a maximum 5 times per year on both sides</td>
</tr>
<tr>
<td>Newly seeded areas</td>
<td>One full cut in first season</td>
</tr>
<tr>
<td>Areas with serious noxious weed</td>
<td>One cut to be arranged where necessary</td>
</tr>
</tbody>
</table>

CARRIAGEWAY CLEANING OBJECTIVE
To remove debris from side channels to prevent surface water ponding and an excess of detritus being washed into gullies.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>STANDARDS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerbed channels</td>
<td>Shopping areas – 4 mechanical and 4 manual sweeps/year</td>
<td>Mechanical sweeps should only be carried out at times when there are no parked cars</td>
</tr>
<tr>
<td></td>
<td>Urban channels – 4 mechanical sweeps/year</td>
<td>Where mechanical sweeps cannot be undertaken because of parked cars then 2 manual sweeps should be undertaken if possible</td>
</tr>
<tr>
<td></td>
<td>Rural channels – 1 mechanical sweep/year plus additional sweep where necessary</td>
<td>The mechanical sweep should include weed spraying of kerbs</td>
</tr>
</tbody>
</table>

Source: Northamptonshire’s Highway Maintenance Plan, 1986-7 (with modifications)
POLICIES ON FREQUENCIES OF ROUTINE MAINTENANCE

Authorities tend to undertake more frequent routine maintenance than recommended in the LAA code.

### COUNTIES

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>LAA CODE</th>
<th>TYPICAL</th>
<th>INTER-QUARTILE RANGE (i.e. THE RANGE IN WHICH HALF THE AUTHORITIES LIE)</th>
<th>LOWEST</th>
<th>HIGHEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical sweeping</td>
<td>2</td>
<td>2</td>
<td>2-6</td>
<td>0.8</td>
<td>13</td>
</tr>
<tr>
<td>– Rural primary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gully emptying</td>
<td>2</td>
<td>2</td>
<td>2-3</td>
<td>0.75</td>
<td>4</td>
</tr>
<tr>
<td>– Urban primary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass cutting</td>
<td>5</td>
<td>5 or 6*</td>
<td>3-6</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>– Urban highways</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic signals</td>
<td>1</td>
<td>1</td>
<td>1-3</td>
<td>0.3</td>
<td>4</td>
</tr>
<tr>
<td>– Inspection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street lighting</td>
<td>6</td>
<td>13 or 26*</td>
<td>6-25</td>
<td>0</td>
<td>52</td>
</tr>
<tr>
<td>– Number of summer scouts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* ie two frequencies are equally common

### METROPOLITAN DISTRICTS AND LONDON BOROUGHS

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>LAA CODE</th>
<th>TYPICAL</th>
<th>INTER-QUARTILE RANGE (i.e. THE RANGE IN WHICH HALF THE AUTHORITIES LIE)</th>
<th>LOWEST</th>
<th>HIGHEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical sweeping</td>
<td>12**</td>
<td>52</td>
<td>36-104</td>
<td>7</td>
<td>520</td>
</tr>
<tr>
<td>– Primary routes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gully emptying</td>
<td>2</td>
<td>2</td>
<td>2-3.5</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>– Primary routes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass cutting</td>
<td>–</td>
<td>16</td>
<td>10-16</td>
<td>5</td>
<td>52</td>
</tr>
<tr>
<td>– Vision splays</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street lighting</td>
<td>6</td>
<td>13</td>
<td>6-26</td>
<td>0</td>
<td>52</td>
</tr>
<tr>
<td>– Number of summer scouts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* * Code gives the frequency for highway reasons only, excluding any amenities element, so comparisons for this item may be distorted

All frequencies are annual except street lighting

Source: Audit Commission questionnaire distributed to all highway authorities, 1986

* Exhibit 12
Case Study 1: REVIEW OF ROUTINE MAINTENANCE

<table>
<thead>
<tr>
<th>Authority:</th>
<th>A county council with 7 agent districts</th>
<th>Date: 1986-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject:</td>
<td>Opportunities For Reduction In Frequencies</td>
<td></td>
</tr>
<tr>
<td>Problem:</td>
<td>Budgets are set mainly on the basis of historic cost rather than needs assessment. The County Council specifies frequencies but these are high compared with the Local Authorities' Code of Practice recommendations. The council's own highways divisions do not achieve the frequencies and the 7 agent authorities do not adhere to them. The outcome is a wide range of unit costs, inconsistent service levels across the County, and County policies not being achieved.</td>
<td></td>
</tr>
<tr>
<td>Action:</td>
<td>The County will ensure that agents comply with its policy on frequencies and will review current frequencies against Code of Practice recommendations. The frequencies of gully emptying will be reduced to Code of Practice levels from April 1988.</td>
<td></td>
</tr>
<tr>
<td>Outcome:</td>
<td>Potential to reduce costs by £1.1m in agent authorities and £0.7m in the County's own operations.</td>
<td></td>
</tr>
</tbody>
</table>

TRIALS OF REVISED FREQUENCIES

41. For all routine maintenance activities there are variations in standards and frequencies between the LAA and the DTp codes (Exhibit 13). This is partly because the recommendations in the LAA Code are averages, while the DTp specifies minima which the Department may raise in response to local circumstances. Another reason is that different standards may need to be applied to urban rather than trunk roads. Nevertheless, assessments of need coupled with trials should be carried out by authorities to evaluate the effects, if any, of moving to DTp specifications. For example, there is evidence from the study, and from the 1987 round of audits, that the recommended frequencies for gully emptying in the codes do not necessarily apply to all gullies. While some may need emptying six times a year others do not need emptying for two or three years or even longer. Auditors have found significant bonus over-claims from operatives who themselves have assessed and applied the needed frequency of emptying while claiming the higher policy frequency. The study team found one authority where some gullies had not been emptied for at least five years yet none had so far flooded.

42. Further research is needed on a particular aspect of policy, the approach to changing lamps in street lights. There are two main strategies:

- burn to extinction, under which lamps are replaced only when they have failed;
- and bulk replacement under which all the lamps of a particular type in a particular area are replaced at the same time.

The LAA Code recommends bulk change without giving the intervals to be used. The DTp also favours bulk change and has specified the intervals. About two thirds of local authorities use bulk change.

43. The Commission's work shows that bulk change is not necessarily the best strategy. To decide which is the most cost effective strategy requires data on lamp lives, the probability that a lamp will fail after a particular number of burning hours, lamp costs
COMPARISON OF THE LAA CODE AND DTp STANDARDS

Some of the frequencies recommended in the LAA code are higher than the DTp specifies for motorways and trunk roads.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>LAA CODE</th>
<th>DTp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweeping</td>
<td>2 (rural primary)</td>
<td>1 (rural motorways)</td>
</tr>
<tr>
<td></td>
<td>1 (other kerbed road)</td>
<td>1 (kerbed trunk)</td>
</tr>
<tr>
<td>52 (town centre)</td>
<td></td>
<td>1 (urban motorways)</td>
</tr>
<tr>
<td>12 (main urban roads)</td>
<td></td>
<td>2 (urban trunk)</td>
</tr>
<tr>
<td>4 (local urban roads)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gully emptying</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Grass cutting</td>
<td>As required (rural)</td>
<td>1 (urban and rural)</td>
</tr>
<tr>
<td></td>
<td>Minimum of 5 (urban)</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit 13

and costs of scheduled and unscheduled visits to columns. Some authorities are collecting this data but there is at present little reliable, objective information on lamp lives. Manufacturers are not always willing to provide data while details they do publish have usually been obtained under potentially unrealistic laboratory conditions. Similarly, there is little hard evidence to support the claim that burning to destruction significantly reduces light output and damages control gear.

44. The limited work done so far suggests it is possible to lengthen bulk change intervals well above the levels recommended by the DTp and that burn to extinction may even be the more cost effective strategy. Experiments conducted in four local authorities (Farnham, Portsmouth, Gosport and Hertfordshire) indicate that just under 70 per cent of SOX type lamps survive 16,000 hours, a life which is double the DTp recommended bulk change interval (Exhibit 14). The implication is that the average highway authority may be able to reduce its lamp change costs by 30-40 per cent.

INVENTORIES

45. Another essential requirement for realistic budget setting is accurate inventories. Inventories are also needed for putting work out to tender, for supervising work properly and for calculating unit costs. Many authorities now have, or are collecting, inventory information, but some still have little information. One quarter of counties lack complete inventories for the fourteen or so basic items which account for 95 per cent of routine maintenance spend, partly because of lack of information about agency areas. Very few authorities indeed have inventories of more esoteric items such as bollards and road studs (Exhibit 15). Metropolitan districts and London boroughs are on the whole better informed than counties but still have weaknesses. Even where inventories exist, they are sometimes estimated rather than accurate; others are out of date.

21
RESULT OF TRIALS OF EXTENDED BURNING HOURS FOR 35 WATT SOX LAMPS

It may be economic to extend bulk change intervals up to 16,000 hours.

Source: Audit Commission analysis of local authority data

Exhibit 14

THE NUMBER OF ITEMS FOR WHICH ACCURATE INVENTORIES ARE HELD BY HIGHWAY AUTHORITIES

Many highway authorities, especially counties, do not possess accurate inventories of even the basic items covering over 95% of scheduled maintenance expenditure.

Source: Audit Commission questionnaire distributed to all highway authorities, 1986

Exhibit 15
46. Inventories are not compiled simply for reasons of bureaucratic tidiness. They can bring real benefits. One authority discovered that it had been under-recording its road length and thus losing block grant. The same authority claims a 20 per cent improvement in gully emptying efficiency since it gave plans of routes and gully locations to drivers. Another authority made savings of between 9 per cent and 61 per cent on various routine maintenance functions once it had collected inventory data and formalised its budgeting. Case Study 2 shows the benefits gained by Warwickshire County Council once it had collected inventory information for grass cutting.

**Case Study 2: MORE SYSTEMATIC APPROACH TO ROUTINE MAINTENANCE**

<table>
<thead>
<tr>
<th>Authority: Warwickshire County Council</th>
<th>Date: 1984-6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject:</strong> Grass Cutting</td>
<td></td>
</tr>
<tr>
<td><strong>Problem:</strong> No clear policy on standards leading to patchy service levels; insufficient information to compile unit costs; budgetting could be nothing other than historically based.</td>
<td></td>
</tr>
<tr>
<td><strong>Action:</strong> Inventory prepared covering county and agent areas. LAA &quot;Code of Good Practice&quot; frequencies adopted, modified for local conditions. Standards defined.</td>
<td></td>
</tr>
<tr>
<td><strong>Outcome:</strong> Budgets are prepared on an assessment of needs basis using accurate unit costs. The work has been subjected to competition and consistent standards exist throughout the county. Annual cost has been reduced by £121,000.</td>
<td></td>
</tr>
</tbody>
</table>

47. Accurate and up to date inventories are particularly important for street light maintenance. Street lights normally use unmetered electricity and bills are calculated using a price per installation. This varies with the overall wattage of the lamp plus its associated control gear and whether the lamp is alight for part or all of the night. In many cases electricity boards use their own inventories rather than details held or provided by the local authority. Comparisons often reveal discrepancies. Some favour the local authority (e.g. the board has not picked up a road adoption); others favour the board (e.g. it has not taken account of conversions to lower wattage, more energy efficient lamps). Some authorities have been substantially overcharged. One has identified overpayments of £125,000 a year (Case Study 3), another has negotiated a repayment for past overcharges.

48. Another advantage of an accurate street light inventory is that it allows counties to make one central energy payment for the whole county, including agency areas. One county has saved two per cent on an annual bill of about £1.75 million i.e. £35,000 a year by providing the board with an inventory and paying centrally. It has also made clerical savings in its own organisation. Centralised payment by a county council also allows it to ensure that it does not meet energy costs — such as charges for lights in parks or car parks — which are not its responsibility and should be paid by its agent districts.

49. The scope and detail of the inventory is partly a matter for local choice, but certain key inventory items ought to be held for important roads, at least in urban areas...
(Exhibit 16). On minor rural roads the information need not be as extensive although it is still desirable for budget allocation and performance monitoring. Appendix 2 sets out what authorities need to take into account when collecting inventories and developing comprehensive highways management systems.

**Case Study 3: OVERPAYMENT FOR ELECTRICITY**

<table>
<thead>
<tr>
<th>Authority:</th>
<th>Hampshire County Council</th>
<th>Date: 1984 to date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject:</td>
<td>Checking Of Street Lighting Energy Accounts</td>
<td></td>
</tr>
<tr>
<td>Problem:</td>
<td>The Electricity Board invoiced Hampshire based on historic information about the number of lamps, the type of lamps and switchgear and the burning regime (all night or part night lighting). Hampshire paid the invoices as rendered because they had no better information with which to check them.</td>
<td></td>
</tr>
<tr>
<td>Action:</td>
<td>Street light maintenance for the county’s directly controlled lighting was put out to open tender and the successful tenderer was required to collect full inventory information as part of the contract. This inventory was then compared with the Electricity Board’s charging schedules.</td>
<td></td>
</tr>
<tr>
<td>Outcome:</td>
<td>The total number of lamps being charged for was 9,800 more than remained in service. The types of lamp being charged for were at variance with those in service and conversions to energy efficient lamps and control gear had not been reflected in the invoices. The authority negotiated a repayment from the Board and there are ongoing annual savings of £125,000.</td>
<td></td>
</tr>
</tbody>
</table>

50. The DTp and Welsh Office are requiring their local authority agents for the motorway and trunk road network to collect basic inventory information and to install their Routine Maintenance Management System (RMMS). The DTp and Welsh Office will make a contribution towards the cost of installing these systems which they hope authorities will extend to their own roads. Several consortia of highway authorities who intend to use the same hardware and software for RMMS are forming. The long term objective is to produce a comprehensive system which will cover all aspects of highways management including inventories, treatment histories, programming of work, resource allocation, traffic modelling and design of schemes. All the systems are based on some form of digital model of the highway network and a detailed inventory.

51. Unfortunately, not all authorities are yet convinced that the benefits of such systems outweigh the costs. The DTp estimates that of its 94 agents about a quarter have considered developments, the rest are waiting to see what happens. It costs about £25,000 to digitise a highway network of around 4,000 kilometres and around £200,000 to collect the inventory information using surveyors. In addition, there are the costs of the computer hardware and software development, but these will be minimised if authorities collaborate on development.

52. Broadly speaking, the annual cost of operating highways management systems for inventory and needs assessment equates to one to two per cent of the maintenance budget, a small price to pay for the potential benefits of such systems — improvements in
ACTION CHECKLIST FOR INVENTORY INFORMATION

Use the following table to check the position on inventories in your own authority

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DOES YOUR AUTHORITY KNOW THE NUMBER AND LOCATION OF THE ITEM?</th>
<th>IS THE INFORMATION UPDATED REGULARLY (eg ANNUALLY IN BUILT-UP AREAS, EVERY 3 YEARS IN RURAL AREAS)?</th>
<th>(FOR COUNTIES) DOES THE INFORMATION COVER AGENCY AREAS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road length by LAA Code classification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Footways by length and width</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precincts by area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of carriage-way channels to be swept</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gullies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street light columns and lanterns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal heads</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illuminated signs, bollards and pedestrian crossings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre lines, edge markings, yellow lines and junction markings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass verges by length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grassed expanses by area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway authority hedges and boundary fences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway authority trees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drainage – ditches, piped drainage, catchpits</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exhibit 16
efficiency and effectiveness which can equate to 10-20 per cent of the budget in authorities currently without adequate information. These benefits are not all directly attributable to highways management systems, but such systems are a prerequisite to their achievement.

BUDGETS

53. Realistic budgets for cyclical activities can be set by combining service level specifications with inventories and unit costs. The annual budget for each function should be calculated according to the formula:

\[
\text{number of items} \times \frac{\text{specified annual frequency}}{\text{agreed unit cost}}.
\]

The amount of reactive work carried out in a year can also be monitored and drawn upon in budget setting. This needs-based strategy is advocated in the LAA Code. Rather disappointingly, having gone through the effort of establishing inventories, less than half of London boroughs and metropolitan districts with inventories use them in the budget setting process. A similar reluctance to use inventories appears to exist in other authorities. Many budgets are still based upon historical spending patterns, and some county councils have found it particularly difficult to change their approach because of problems with agency and confusion about the roles and responsibilities of counties and districts. Historical budgeting helps cause the over or under provision of service discussed earlier, as the funds provided determine what is done rather than any explicit policy. It also means that resources are not necessarily allocated where they are most needed.

PAYING THE RIGHT PRICE

54. Many authorities would make major savings by reducing their unit costs for routine maintenance to those already achieved by the best quarter (Exhibit 17). Exhibit 20 (later) shows the good practice costs which authorities should aim to achieve.

55. The typical range between the most and least economic quarter of authorities is about 1.6 to 1. A small part of this variation is due to differences in the frequency of routine maintenance, and part to regional differences in wages. The latter effect must be quite small as a proportion of the total, because the special study has revealed cost differences of at least 2:1 between neighbouring authorities.

56. The Commission’s questionnaires to county councils, London boroughs and metropolitan districts were analysed to see whether there was any relationship between the unit costs and frequencies. No correlation was found for mechanical street sweeping, street light or traffic signal maintenance but a correlation was found for gully emptying and grass cutting. For example, each additional cut per year achieved an average reduction in the unit cost per occasion cut of £1.34 per swathe kilometre. However, even when these and other factors are taken into account, there remains a wide range in the unit costs which is due to the extent of competition, the degree of attention paid to DLO bonus schemes, the efficiency of vehicle scheduling and the levels of DLO and contractor supervision.

57. The comparison of unit costs reveals that in England and Wales £90 million a year could be saved on routine maintenance and diverted to much needed structural
maintenance. To achieve this, authorities need both to improve the efficiency of direct labour and to make more use of competitive tendering, to ensure that direct labour is efficient and that private contractors are not charging excessive prices. Putting work out to tender will reduce unit costs irrespective of who wins the work. This is due both to the scrutiny a function needs to receive before it is put out for tender and to the stimulus of the competition. For example, counties which had put gully emptying out to tender achieved an average of 128 gully empties a day compared with 98 for those which had not. Wiltshire County Council achieved a substantial increase in gullies emptied per day after putting the work out to tender, primarily from an extension of the working day. In order to be truly competitive, an authority should aim at target costs at the best decile as it is at this level that the private sector is likely to tender.

58. Competition. Direct labour is quite capable of successfully competing for work against the private sector, except for certain specialised work such as road markings. An efficient DLO will force contractors to cut their margins and for many jobs will be able to undercut the contractors. However, some authorities have a policy of awarding their DLOs as much work as possible without competition. This has been particularly easy to do for routine maintenance as many of the activities, such as sweeping and gully emptying*, are not covered by the Local Government, Planning and Land Act 1980, while others such as road markings, often involve small jobs below the threshold at which work must be awarded competitively. The desire to protect direct labour has also led some authorities to use such devices as unrealistically short contract periods or unusual and unrealistic work mixes when seeking tenders. Not surprisingly there is then little interest from the private sector. For these and other reasons, only about 20 per cent of routine maintenance work in counties, for example, has been put out to tender; the rest being awarded directly to the DLO without competition.

59. Although the position will change with the Local Government Act 1988, failure to expose direct labour to competition means that routine maintenance work is currently being carried out less efficiently than it might be. This is particularly true of mechanical street sweeping and gully emptying where DLO bonus schemes have not been updated to take account of improved equipment. Stockport MDC revised its bonus scheme in 1986 and now achieves 180 emptyings per crew per day. Most mechanical sweepers are capable of sweeping at four to five miles per hour, whereas many bonus schemes are still based on historic speeds of 2.5 miles per hour. As a result, employees can earn a full bonus for only a part day’s work, with predictable results. Auditors have detected a number of bonus frauds in the current round of audits. Case Study 4 shows the benefits gained by one authority which revised its sweeping bonus.

60. Traffic signal maintenance and street lighting particularly benefit from competition. Much traffic signal maintenance involves complicated electronic and electrical equipment and is normally carried out by specialist contractors. This is often the supplier of the original installation, an approach which used to be recognised as sound practice by the DTp. The Department undertook national negotiations with contractors and instructed its agent authorities on which to use. It abandoned this role in 1982 and

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* The position on gully emptying and street lighting has been unclear. The DTp and DOE have advise authorities that gully emptying should normally be treated as not covered by the Act and street lighting conversely. Many authorities nevertheless treat street lighting as excluded, which has the effect of raising the proportion of work not subject to the Act.
THE RANGE OF UNIT COSTS FOUND BY THE COMMISSION

Major savings can be made if all authorities achieve good practice unit costs

UNIT COSTS FOR MECHANICAL SWEEPING

<table>
<thead>
<tr>
<th>Good Practice</th>
<th>Counties</th>
<th>£5.85</th>
<th>Other</th>
<th>£3.50</th>
</tr>
</thead>
</table>

UNIT COSTS FOR STREET LIGHT MAINTENANCE

| Good Practice | £14.20 |

UNIT COSTS FOR STREET LIGHT ENERGY

| Good Practice | £13.50 |

Source: Audit Commission questionnaire and study fieldwork data
UNIT COSTS FOR GULLY EMPTYING
Good Practice £1.40

UNIT COSTS FOR GRASS CUTTING
Good Practice 1.0p

UNIT COSTS FOR MARKINGS
Good Practice £0.18

Exhibit 17
some authorities have since put maintenance to open tender. Major manufacturers will maintain other suppliers' equipment. In addition, contractors usually offer a lower price per installation the greater the number being maintained. Open tendering has produced major savings; one county’s costs fell by over £200,000 a year.

**Case Study 4: OUTDATED BONUS SCHEMES**

<table>
<thead>
<tr>
<th>Authority:</th>
<th>A Metropolitan District Council</th>
<th>Date:</th>
<th>1986-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject:</td>
<td>Mechanical Street Sweeping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem:</td>
<td>The unit cost for mechanical sweeping was £6.06 per swept channel kilometre compared with the Commission’s good practice benchmark cost of £3.50 (which was achieved by a neighbouring authority). Although the bonus scheme had been reviewed in 1986 no change had been made to the standard minute value for sweeping one mile of carriageway. This value had been set in 1981 and represented an average sweeping speed of only 2.7 miles per hour.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action:</td>
<td>Bonus scheme values are being reviewed and brought into line with the capability of the present sweeping equipment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome:</td>
<td>Potential annual cost reductions of £97,000 for the same levels of service. The review has also focused the DLO’s attention on the need to make itself competitive if it is to be successful in winning the work in open competition.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

61. Electricity boards maintain street lights for some authorities. Prices are usually low when they have won the work by tender but are often high when it has been awarded without competition. Boards which have been required to compete have reduced their prices by as much as 30-50 per cent or lost the contract. One county council has identified savings of £1 million a year in street light maintenance caused by inefficient DLO practices.

**SUPERVISION AND PERFORMANCE MONITORING**

62. Supervision of routine maintenance is often poor, irrespective of who does the work. In the past, highways engineers have not thought it necessary to supervise their DLOs, relying instead on the DLO’s own supervisors. When direct labour is used, DLO management often provides the only supervision. However, DLO managers who are also expected to supervise on behalf of the client face a conflict of interest. The client side* engineers often have no idea about the routine maintenance being carried out by their authority, other than knowing the overall level of expenditure. In most authorities, no one acting solely for the client has details of routes or carries out spot checks to see that work is being performed. Authorities which already use the private sector for sweeping and gully emptying have found that strong supervision is essential to ensure performance. Greater client side supervision is needed. In any case, there has been a tendency recently for DLOs to trim their supervisory levels to make themselves more competitive; this has shifted the onus of supervision on to the client side.

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* See paragraph 130 for the definition of client side
63. Particular problems arise with street lighting. There is often no separation of duties between the organisation identifying the need for work and the one actually doing it. Some authorities allow their DLO, or the private contractor responsible for maintenance to scout for outages and so effectively generate their own work. In some cases, repairs are carried out without first passing the report to the client for him to authorise the repairs. If reports are received, sites are not always visited to check that the outage exists and that work has been carried out. This contrasts badly with the often excellent office systems used to reconcile outage reports with invoices for repairs. Since, in some authorities, over 30 per cent of the lighting stock is reported as being out at sometime during the year, proper supervision of scouting is crucial. In addition, few authorities analyse reports, by route, for unusual patterns of outages — while complaints from the public about lights are not always compared with scouting reports or maintenance records.

64. Bulk changes of lamps are often badly supervised. Work by the Commission and its auditors shows apparent premature failure rates between bulk changes as high as 25 to 30 per cent in some authorities. Such high failure rates suggest that not all lamps are actually being replaced, especially when the bulk change intervals are at comparatively low burning hours. Some authorities have addressed the problem. One county using a private contractor for maintenance requires him to draw lamps, indelibly stamped with the date of issue, from county stores. This, plus a detailed knowledge of the planned replacement cycle, allows a check that bulk change has taken place. Approaches of this sort, requirements that used lamps be returned to the authority for disposal or that the authority attend or supervise disposal, are essential.

65. As well as providing adequate supervision, authorities need to monitor their own performance. Such monitoring processes also provide authorities with the unit costs which form an input to the next year's budgeting cycle. In gully emptying, for example, the number of empties carried out in a year could be compared with the inventory and service level specification and an actual cost per empty compared with the figure assumed when setting the budget. Since gullies are emptied to ensure that they do not block and flood, the number which do flood, or which silt up and therefore need to be emptied by hand, can be monitored to see whether the policy is succeeding.

66. Many authorities do not know what their performance or unit costs are and have no idea what they are achieving with the money they spend. London boroughs and metropolitan districts tend to be poorly informed on unit costs. For example, less than half those surveyed have a unit cost for street sweeping while one third have no unit cost for gully emptying (Exhibit 18). The position in counties has been complicated by agency problems and disagreements about the extent to which agents should or should not be accountable to the county council. As a result, counties tend to be better informed about performance on, and costs of, directly performed work than about agency areas. The Commission's interim report on agency has already recommended improvements in this area: agents should provide end of year summaries to the principal, supplemented by exception reports, with sample financial and technical audits being carried out by the county.
A substantial proportion of authorities, particularly counties, do not know their unit costs for four routine maintenance activities:

- Street lights maintenance
- Gully emptying
- Mechanical street sweeping

Exhibit 18
67. Exhibit 19 summarises the key questions on routine maintenance that authorities should be asking themselves. Exhibit 20 sets out the good practice indicators against which authorities should be measuring their own performance.* If all authorities could achieve the performance of the best quarter, then potentially £90 million a year could be saved on routine maintenance in England and Wales and diverted to much needed structural maintenance. If authorities achieved the performance of the best 10 per cent then the savings would be about £120 million a year.

KEY AREAS FOR CONSIDERATION IN ROUTINE MAINTENANCE

Authorities need urgently to address these issues:

**Inventory**
Is there an accurate and up to date inventory?
Does it include agents?

**Standards and frequencies**
Has a policy on standards and frequencies been documented?
Is a clear distinction made between work undertaken for amenity purposes and safety/maintenance purposes?

**Budgeting**
Is the budget calculated according to the formula:
inventory x unit cost x frequency?

**Client-contractor split**
Is there a separation within the authority between the client and contractor role? For example, are the maintenance and scouting functions for street lighting separated? Is there client-side supervision of the DLO?

**Tendering**
Is the majority of routine maintenance put out to tender?
In particular, is the authority dependent on the electricity board for street lighting maintenance?
Has traffic signal maintenance always been done by the equipment supplier? If road markings are done by the DLO, what is the justification?

**Supervision**
Is the level of client-side supervision adequate?
Are the DLO’s and contractors’ internal supervision levels adequate?
When were the DLO’s bonus schemes last reviewed?

* The indicators have been updated to 1987–88 costs.
GOOD PRACTICE COSTS FOR ROUTINE MAINTENANCE

If authorities could achieve these costs, savings of £90m pa could be made in routine maintenance and diverted to structural maintenance.

Photograph courtesy of the Transport and Road Research Laboratory

Exhibit 20
WINTER MAINTENANCE

68. Local authorities in England and Wales spend around £100 million a year on salting and snow clearing operations (Exhibit 21). Generally in England and Wales, snow clearing only takes place for about two weeks of the year (though there are exceptions — Cumbria can have 40 or more snow clearing days a year, for example). Most of the money spent on winter maintenance therefore does not go on clearing snow but on salting the road — either pre-salting to prevent ice forming or post-salting to melt ice after it has formed. Post-salting can also be used to melt thin, freshly fallen snow but it is pointless once snow is hard packed. Most authorities have a ‘stand by’ season during which they carry out salting, at short notice, in response to weather conditions. As ice usually forms on roads during the hours of darkness, most salting is carried out in the evening, night or early morning.

THE MAKE-UP OF THE HIGHWAYS MAINTENANCE EXPENDITURE FOR LOCAL AUTHORITIES IN ENGLAND AND WALES, 1986-7

Winter maintenance accounts for eight and a half per cent of the expenditure

Exhibit 21

69. Despite the reactive nature of the work, most winter maintenance can be managed in a way broadly similar to that used for routine maintenance (Exhibit 22). Parts of this management cycle can be found in most authorities but few have the complete cycle in place. Most authorities can therefore make improvements to their winter maintenance activities. The following sections set out the most efficient and effective practices observed by the Commission.
THE MANAGEMENT CYCLE

70. As with other types of maintenance it is necessary for the authority to set policies and standards and the strategy for achieving them. This requires a policy document or 'battle plan' covering, for example, the route network, the response time, the salt spreading rates and the manpower strategy. The LAA Code sets out the issues which should be included in such a policy document.

POLICY

71. All highway authorities designate priority roads that are to receive preferential treatment both for salting and snow clearance. Some go further and have up to four sets of routes in some cases. Authorities frequently also quote a response time for salting priority routes; that is, the time between a decision to salt and the vehicles' return to depot. Typical times are two to 2.5 hours although the range can be between one hour and six hours. Some authorities also set additional standards, such as that all roads are to be treated by 7.30 a.m. so that salt is in place before the morning rush hour. Most follow the LAA Code and accord the highest priority to salting principal roads, roads leading to important establishments such as hospitals, bus routes, major commuter routes, etc. Others do not. In addition, in some authorities, roads are given priority in response to bids from middle tier officers (area engineers, etc.). Different employees can have different views on what type of road should receive attention first and there can be wide variations in standards even within the one authority. These variations within an authority indicate inconsistent standards and need to be minimised. The position in counties is further complicated by agency. District councils often ignore any guidance given by the highway authority and apply their own standards.

BUDGETS

72. There is a strong historic element in budgeting for winter maintenance. Once policy guidelines are established they should be used to set budgets. Authorities should measure the length of their priority and other routes, use preferred spread rates to calculate expected salt use, compare the number of frost days with call outs over the last three to five years and use the data to set a salting budget. A three to five year average expenditure on snow clearing can also be calculated and added to the budget provision.

STRATEGY

73. Routing Efficiency. Salting length is important in designing efficient routes. There are important economies to be made by rationalising salting routes to reduce dead travel. The most efficient routes found by the Commission have a salting length of around 30 miles each. This fits in with the typical response time of two to 2.5 hours favoured by authorities. Routes are often dealt with on a territorial basis — with an area engineer or an agent dealing with all salting within their area. Routes are also frequently worked out on an ad hoc basis by comparatively junior staff. A more formal approach should be followed with routes being devised centrally and running across area (or agency) boundaries, if this is efficient. In addition, modern salt spreaders are capable of covering both sides of a single carriageway road in a single pass; there is no need to pass along both sides of the road, a practice which not only wastes time but often contributes to the over-application of salt.
74. Routing efficiency, defined as the proportion of salting mileage to total mileage, varies considerably from authority to authority and division to division. The Commission has found priority routes in the same division of a county where the salting mileage varies from only 40 per cent up to 93 per cent of the distance travelled by the vehicle. Few authorities appear to have attempted to optimise the salting mileage of their priority routes, let alone the secondary and subsidiary routes.

75. Call Out Criteria. Having established what they want to do, and on which roads, it is vital that the decision to treat is based on the best available information. A single salting turn out in an average county costs approximately £15,000 and the decision to go is often based on limited information or made at junior level. It is often made at the wrong time of day. All authorities receive weather forecasts and road danger warnings from the Meteorological Office. Monitoring of the forecasts has shown them to be no more than 55 per cent accurate. They are also received too early in the day for them to be the sole reason for salting. Many authorities act on this level of information alone and are in danger of
abortive salting or, equally importantly, failing to salt when conditions require it. Salting is only necessary when temperature and humidity combine to produce ice or snow. There is no point in salting cold but dry roads, particularly those with salt left from previous saltings. It is therefore necessary to inspect the network or known trouble spots to check actual conditions and to use the most up to date forecasting information available.

76. In 1986–87 the Meteorological Office introduced a new forecasting package called Open Road which is designed to give better quality, more up to date information, but to date only about one third of authorities use it. The initial appraisal is that this system has greater accuracy. Authorities can also subscribe, at extra cost, to a service which allows any authorised officer to speak directly to a weather forecaster on an ex-directory line. This has the advantage that the forecast can be regularly updated giving a more accurate prediction, which the Commission’s study considered a cost effective service. One authority also has radar facilities which allows it advanced information on weather approaching its area.

77. An increasing number of authorities are installing road sensor equipment linked to central displays. They may also be linked to a forecasting system which will predict when and where on the network ice is likely to form. Road sensors should be located at critical points in the network such as known cold spots. The required number and position can be identified by thermal mapping the network. These systems have the advantage of transmitting accurate, up to date information relevant to the individual authority. However, they are costly. Thermal mapping costs approximately £100 per kilometre using road vehicles and around £500 per kilometre for an aerial survey. Road sensor points and landlines are approximately £10,000 each and a forecasting system and its associated computer can cost around £200,000.

78. Authorities must carry out a careful cost benefit analysis before investing in this technology. Thermal mapping should make it possible to redesign gritting routes or restrict the scope of call outs in marginal conditions, but the study found no examples of authorities which already have the technology exploiting it in these ways. Sensor data on actual conditions is rarely compared with the forecasts available when a decision to salt or not salt is made, or used to help refine models and decision making.

79. Call out decisions are still often made without these technological aids by junior managers or supervisors, often DLO staff rather than clients. They tend to err on the side of caution, which leads to waste and over salting. Poor performance monitoring means that authorities rarely spot and correct this. Authorities’ stand by arrangements also influence decisions. Some have agreements with employees which require them to give early notice of call out, sometimes even before the end of the normal working day. The earlier the decision, the more likely it is to be wrong. Well defined call out criteria are important and work should not be allowed to start without proper authority. The roads to be dealt with should also be clearly identified.

RESOURCES

80. The Use of Labour. Most winter maintenance is undertaken by DLOs. There are four main operating strategies for out of hours winter maintenance operations:

- standby,
- stand to,
- full night shift;
- voluntary system.
Most authorities operate a stand by system during the winter season, calling out DLO employees, who normally do other work, as needed. In most cases, the employees receive a stand by payment, irrespective of whether they are called out, and are paid overtime for actual call outs. Stand to systems involve no stand by payment but employees report at, say, 05.30 each morning irrespective of weather conditions and are paid whether they turn out or not. A minority of authorities operate permanent night shifts. These are expensive and are normally justified only in rural areas with long salting routes or where response times would be excessive if crews had to be called from home. Authorities with night shifts should therefore review their justification. Voluntary call out systems involve no payments except for call outs. These rely heavily on the goodwill of the workforce.

81. The stand by periods used by authorities vary between 12 weeks in some authorities and 23 weeks in others, with obvious repercussions on the amount of money paid out in stand by allowances. Authorities should examine records of actual weather conditions, and turn outs, to check that they are not using too long a season. The number of employees on stand by (or on the night shift) depends on the number of priority routes and offers some opportunities for economies. The study indicates that as a broad rule an average of 1.5 employees including supervisors, mechanics and depot hands, per route is needed if salting machines are single manned. The equivalent average is 2.4 per route if machines are double manned.

82. While double manning is usual for snow ploughing, it is not needed for most normal salting. Double manning, particularly in built up areas such as London and metropolitan districts, should be reviewed. Some metropolitan districts have introduced single manning as a result of the study. Some authorities' labour agreements also require them to use employees in the evening (e.g. before 8.00 p.m. or before midnight) rather than in the early morning (4.00 a.m. or after). Salt spread too early in the evening can be removed from the road by the action of traffic, blown off by the wind or washed off by rain long before ice starts to form. In these circumstances, at best the salting run may have to be repeated once ice has formed; at worst, the ice will remain untreated. In either case the original salting turn out will have been a waste of resources.

83. The Commission has found bonus schemes which are linked to speed over the route or the volume of salt spread. These simply encourage drivers to exceed the 20 miles an hour which equipment manufacturers recommend as the optimum spreading speed, and to spread at much higher rates than is necessary. Bonus, if paid at all, should be at a predetermined fixed percentage or the average paid for other highways work in the relevant period.

84. Some authorities have allowed snow clearance work to determine the size of their highways DLO despite the fact that snow clearing is only carried out for five per cent of the working year. This approach encourages the DLO protectionism discussed elsewhere in this report. Authorities need to make more use of their own non-highways employees while county councils can also come to arrangements with agent and non-agent districts to use their sweeping and parks staff. Private contractors and, in rural areas, farmers can also be employed.

85. Vehicles and Plant. Having established the routes, set the response time and optimised the route lengths and efficiencies, authorities then need to match the number and size of gritters to the network. Many winter maintenance fleets are a hotch potch of converted refuse freighters, ex-army lorries and assorted fixed and demountable gritters whose size and carrying capacity bear little relationship to the workload. The Commission
has established two measures to test the appropriateness of an authority's fleet:

- vehicle units per priority route including reserves 1.3
- carrying capacity per 100 salted miles 25 cubic metres

Over capacity can lead to too much salt being used because unnecessarily large vehicles are loaded to capacity and all the salt dispensed.

86. In establishing their fleet, authorities should also consider the relative merits of dedicated or demountable gritters. Dedicated, purpose built gritters are expensive to buy, cannot be used for any other purpose and will stand idle for the greater part of the year. They are, however, of greater capacity (up to nine cubic metres) than demountables, allowing longer routes or fewer vehicles to cover a network. Demountable bodies are relatively inexpensive and allow the carrier vehicle to be used for other purposes during the rest of the year. European countries use demountables almost exclusively. Authorities also hold equipment for snow clearance ranging from detachable snow blowers and ploughs to self-propelled blowers and JCBs. Bulldozers are also used if necessary but are usually provided by contractors. Self-propelled purpose built blowers are very expensive — £50,000 to £100,000 each. Authorities holding, or considering the purchase of, purpose built machines need to be satisfied that their weather and topography warrants it. It is difficult to justify the equipment in simple cost efficiency terms in most parts of the country where snow lies on the ground for two weeks or less each year.

87. Materials. The main material used is rock salt. Although by far the cheapest material in terms of initial cost (typically £18-20 a tonne), it is highly corrosive and environmentally damaging. The total cost of using salt has to be measured in terms of damage to road structure, bridges, public utility services, vehicles and the environment generally. Against these must be set the fact that it is a generally effective material for the purpose, reduces accidents and allows the nation to continue to go about its business.

88. Other materials do exist, including urea, liquid polyglycol and calcium magnesium acetate. All are much more expensive than salt and are therefore used in relatively small quantities for specialised purposes. Urea is not corrosive but costs £160 per tonne. It is used only on bridges or long sections of elevated carriageway. Salt is likely to remain the prime material for the foreseeable future. With this in mind, the study has identified three key areas for authorities to consider regarding the use of salt. These are: how it is purchased, how it is stored and how it is spread.

89. Purchasing. The volume of salt used is increasing dramatically (Exhibit 23). Most rock salt is supplied from a mine in Cheshire owned by ICI, which is almost the only domestic source. Authorities purchase salt costing £40m a year from it. ICI operate a three tier price structure depending on the time of year the authority places its orders. The lowest price requires orders to be placed before 30 April. As the authority is required only to have placed the order, not taken delivery of the salt by that date, there is little excuse for any authority not to buy the bulk of its requirements at the most favourable price. Some authorities, particularly those close to port facilities, have been able to import salt more cheaply from abroad than ICI can supply it. It is also possible to buy ICI salt from independent haulage companies who are prepared to undercut ICI's haulage rates. Authorities should be aware of these alternative sources. ICI's salt is required to conform to a British Standard Specification (BS 3247). One authority was able to claim a refund of almost £25,000 because some deliveries did not meet this specification. This demonstrates the importance of testing materials.
SALT PURCHASED IN GREAT BRITAIN FOR ROAD DE-ICING PURPOSES 1960-86

The volume of salt used has risen dramatically

Source: Estimates provided by ICI

90. **Storage.** The most usual method of storing salt is in the open. This causes two problems — the salt gets wet and is washed away by rainfall (leaches) and coagulated salt cannot be spread at the desired rates. The TRRL has calculated that salt loss through leaching is equivalent to up to 0.25 per cent of the total stockpile per inch of rainfall annually. Taking average annual rainfall at 30 inches, the loss in 1986 was up to 188,000 tonnes costing up to £3.6 million. The TRRL has calculated that coagulation results in an overspreading of up to 18 per cent by volume. In 1986 this was equivalent to 450,000 tonnes costing up to £8.7 million.

91. There are two possible solutions. Salt can be stored in the open but covered by polythene sheeting. Some authorities which have tried this approach have experienced handling difficulties, especially when it is windy and it is not normally popular with staff. Others have used it successfully. In one county the cost of covering 3,000 tonnes of salt for five years was £5,000 — obviously cost effective. The second approach is to build salt barns. In some authorities the capital cost of these buildings is high, typically £70,000-£80,000 giving pay back periods of up to 10 years. This is often because the buildings have been over-specified. The Commission has been shown some relatively simple wooden structures, with the salt stored against, for example, railway sleepers and where the costs have been recovered in three years (Exhibit 24). However, when considering the economics of open or covered storage in their individual circumstances, local authorities should also recognise differences between types of salt, some of which thatches to form a crust when stored in the open.
A SIMPLE SALT BARN

This simple wooden salt barn makes effective use of railway sleepers and has a payback period of about 3 years

Exhibit 24

92. Spreading. The recommended rates of spread are 10 grammes/square metre for pre-salting, 20 grammes/square metre for post-salting and 40-60 grammes/square metre for melting light snowfalls. Virtually all authorities make these rates their target. In practice, actual spread rates vary greatly, often without the authority being aware of it. Actual average spread rates calculated by the Commission in the study authorities varied from 20 grammes/square metre to 83. This is caused by two way spreading, too large vehicles, open storage of salt and ineffective management control. Another more immediate reason is the failure to calibrate the spreader mechanisms of the vehicles for volume and width of spread. In one case identified by a county council, the target spread could have been achieved with only half of the salt actually used (Exhibit 25). Relatively inexpensive electronic equipment is available to control spread rates from the cab of the vehicle. Such equipment is used abroad but rarely in this country, and authorities should evaluate its cost effectiveness.

93. A common European practice is to set the spread width two metres less than the width of the carriageway. Thus one metre each side of the carriageway is not initially salted, but the action of passing traffic spreads the salt towards the edges of the road. Adopting this practice and spreading at the correct rate would save 25 per cent of the salt, worth £10 million a year in England and Wales.
A COMPARISON OF TARGET AND ACTUAL SALT SPREAD RATES FOR ONE AUTHORITY

The target spread could have been achieved with only half the salt actually used.

Source: Lincolnshire County Council

Exhibit 25

94. The DTp and some authorities are carrying out trials of adding calcium chloride or brine to the salt at point of delivery through a tank mounted on the vehicle. This wets the salt after it has passed through the spreader and helps it to stick to the road surface. The technique may be cost effective in particularly wet and windy parts of Britain and, again, is widely used in Europe.

95. If local authorities buy, store and spread salt in the ways indicated in this report, total consumption could be reduced by 60 per cent nationally (Exhibit 26). This would be worth £21 m a year in the cost of salt alone. It would also have considerable environmental benefits. As a conservative estimate, in the medium term, savings of £15 million a year should be feasible.
THE NATIONAL POTENTIAL FOR SAVING SALT

Source: Audit Commission projection based on TRRL data

Exhibit 26
3. Effective Structural Maintenance

96. In this report, the term 'structural maintenance' is taken to cover potholing, patching, haunching, kerbing and footpath maintenance, drainage, earthworks and embankments, surface dressing, resurfacing and overlay, reconstruction and bridge maintenance. In 1986-87 £675 million was spent on these activities (Exhibit 27). Practically all of this work is plannable although some potholing is justifiably treated as emergency work. Essentially the authority must measure condition, set policies which means deciding on the condition standards it wishes to provide, decide intervention levels, prioritise treatment methods, fix budgets accordingly and then arrange for the work to be performed either by DLO or contractor, ensure that it is paying competitive prices, supervise the work properly and monitor overall performance. Each of these topics is dealt with in this chapter.

THE MAKE-UP OF THE HIGHWAYS MAINTENANCE EXPENDITURE FOR LOCAL AUTHORITIES IN ENGLAND AND WALES, 1986-7

Structural maintenance accounts for about three fifths of the expenditure
97. Potholing, patching and haunching are the least technical of the carriageway repair activities and between them account for up to 20 per cent of the structural maintenance budget of a typical highway authority; nationally about £130 million a year. Individually these are likely to be small jobs and traditionally they are carried out by DLOs. All are programmable and the workload should arise from inspection and condition assessment. Some potholing will require faster responses but it should still be possible to draw up programmes, for example, covering all the work in one geographical area at the same time.

98. Surface dressing and slurry sealing seal the road, prevent water reaching the foundations and restore lost resistance to skidding. Such interventionist maintenance should be performed at regular intervals if a road is to achieve its design life. The national expenditure is around £90 million annually. In unit cost terms, it is the cheapest method of restoring carriageway surfaces and its use has increased considerably over the years. As Exhibit 28 shows, surface dressing is the predominant treatment, especially on non-principal roads, where the length of road dressed each year is over six times greater than that resurfaced or strengthened. This is partly due to budgetary constraints, which means that surface dressing is sometimes used where condition surveys indicate that resurfacing is really the treatment required. Surface dressing is generally unpopular with the public and is used more in rural areas than on urban sites.

99. In evidence to the Transport Select Committee inquiry into road maintenance in 1983, the County Surveyors' Society commented that local authorities have tried to concentrate expenditure cuts on amenity aspects of road maintenance, but inevitably they have had to fall back on low cost short term remedial measures such as extensive patching and surface dressing.

**TRENDS IN LOCAL AUTHORITY ROAD LENGTHS RECEIVING DIFFERENT MAINTENANCE TREATMENTS**

Surface dressing is the predominant treatment

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Exhibit 28

Source: National Road Maintenance Condition Survey, 1986
100. Resurfacing and overlay require either the removal of the old surface and its replacement with a new surface (resurfacing) or laying a new surface on top of the existing one (overlay). This again is interventionist maintenance which should be carried out at predetermined intervals in the design life of the road. Highway authorities spend approximately £100 million annually on these activities. There has been a sharp decline in expenditure on strengthening and resurfacing, especially of principal roads.

101. Reconstruction takes place when the whole carriageway or part of it has reached the end of its life or there has been a failure of the foundation. The whole of the road structure is removed and replaced with new materials. This is the most expensive structural maintenance activity and the most technically demanding. Local authorities spend £110 million a year on it.

102. Footpath and kerbing works have become an area of great public concern especially in recent years and local authorities have responded by directing more money towards their maintenance. Footpath repairs often figure in disputes between counties and agent districts. The latter often give the footpaths a higher level of priority than the county does and districts may vire money away from other maintenance activities to increase the allocation to footpath repairs. The total annual spend on footpaths and kerbing is about £150 million. Expenditure on footpaths decreased significantly between the mid and late 1970s, but began to rise again in the mid 1980s.

103. The prime objective of drainage and earthworks maintenance is to ensure that major problems do not arise. For drainage, this is achieved by regular inspection and clearing of grips, culverts and ditches and for earthworks and embankments, by ensuring that the stability of slopes and cuttings are maintained.

104. Bridge maintenance is also preventative with regular programmes of painting, pointing and minor repairs arising from regimes of continuous inspections. Currently, there are major national problems with the condition of road bridges in England and Wales.

STRATEGY

105. The policy objective of structural maintenance is to keep the highway in a safe condition for the passage of traffic and to maintain the structural integrity of the highway. Authorities must define and document their strategy and standards for achieving this objective.

106. Standards for the main structural maintenance activities (potholing, patching, surface dressing, overlay and resurfacing, reconstruction, footpath repairs and kerbing) should all be based on defined intervention levels and types of treatment. The LAA Code of Good Practice sets out guidelines covering all the activities discussed in this chapter; many authorities have now fully or partially adopted the Code.

107. The work should arise from a regime of regular inspections of the whole network. Potholing, patching and footpath repairs are usually identified in this way and should then be compiled into a programme rather than dealt with in a piecemeal or ad hoc way. Some potholing work will have to be dealt with quickly, but again this can be programmed. The need for surface dressing, resurfacing, overlay or reconstruction works will also be identified by inspection, normally using the technical assessment systems described below.

108. For drainage and earthworks activities, planned programmes of inspection are required. Similarly, with bridges, the authority should be carrying out continuous programmes of inspections and routine maintenance. Inspection standards have been
specified by the DTp in *Technical Memorandum BE4/77*, subsequently amended in 1979 and now incorporated into BS5400 part 2. These standards are mandatory for bridges on trunk roads and motorways and their application to all local authority roads is recommended in the LAA’s Code. To achieve them requires a structured inspection regime.

**NEEDS ASSESSMENT**

109. Systems are needed for allocating funds to different activities and to different geographical areas within the highway authority. Most highway authorities use technical assessment systems but often not for budgeting. On their own roads they are likely to use MARCH (Maintenance Assessment Rating and Costing of Highways) or CHART (Computerised Highway Assessment of Ratings and Treatment) or a locally developed derivative such as ASPECT. These systems use information on the condition of the highway network gathered in a structured format by visual inspection and rank it to produce a programme of work. They have the advantage of containing a formalised defect ranking which allows comparisons of overall condition to be made in different parts of the same authority. The systems then give priorities to the list of defects identified. This makes it possible to direct resources to the areas of greatest need.

110. These assessment systems can be supplemented by the use of deflectographs and SCRIM (Sideways Force Coefficient Routine Inspection Machine). The SCRIM measures the residual skid resistance of the road surface. The deflectograph is a machine mounted on a heavy goods vehicle chassis which is capable of exerting a controlled load onto the highway as it passes along it. The degree of deflection in the road structure caused by the application of the load is measured by the machine and gives information on the need for structural repairs to the highway. Deflectographs are very expensive machines — around £150,000 to buy. They are normally owned by the DTp or a consortium rather than individual authorities. Although owners of the machines will normally make them available for hire, not all authorities use them. Deflection surveys cost around £100 to £200 per kilometre of road.

111. It is disappointing that while many highway authorities are increasingly using condition surveys to monitor trends, few are using surveys as a basis for allocating funds within the authority. The former West Midlands County Council surveyed all its roads every three years and used the survey results to allocate funds between divisions and agents. The survey showed clearly that historical allocation patterns did not match needs, particularly in two areas (Exhibit 29).

112. Many highway authorities are, however, using condition surveys to monitor trends and make a case for the required expenditure on structural maintenance. Highway authorities participate in the National Road Maintenance Condition Survey (NRMCS), and several extend the survey to more sites than the NRMCS requests.

113. A number of authorities are considering the implementation of highways management systems incorporating inventory, technical assessment, budget allocation, preparation of bills of quantity, contracts, specifications and works orders, budget monitoring and the preparation of whole life costing models designed to analyse the state of a road network, predict maintenance intervention periods and evaluate the most cost-effective maintenance technique. These systems are also capable of carrying out non-maintenance activities such as traffic modelling and the design of improvement schemes. Appendix 2 discusses these systems in more detail. The Commission welcomes
such developments and encourages authorities to use them.

114. In the absence of objective information about road condition it is harder for engineers to protect structural maintenance expenditure when funds are tight. The lack of information in the past has allowed structural maintenance to receive less priority than routine maintenance. In some authorities, structural maintenance accounts for only 30 per cent of the budget. In the average authority, it accounts for 59 per cent of the budget. The Commission’s study indicates that this should be increased to 65 per cent in order to arrest the decline in road condition.

115. The companion report on the national picture examined the expenditure required to halt the decline in road condition, and showed that total expenditure in England needed to be 107 per cent of the 1987–88 GRE allocation. Therefore, as a rule of thumb, authorities that do not have road condition information as a guide should be aiming to spend 107 per cent of their 1987–88 GRE for highways maintenance, and then allocating 65 per cent of that to structural maintenance. But the precise level of required spending will of course vary from place to place. They should be setting up road condition surveys to provide a more objective assessment of the required level of expenditure.
BUDGETING

116. In most authorities, funds are distributed on the basis of historic patterns rather than being directed to the areas of greatest need. Budgeting usually involves each divisional surveyor of a county and/or each agent authority carrying out the assessment and inspection of their own area and preparing a bid by submitting a list of schemes they consider necessary. If a prioritising system was then properly applied it would rank the jobs across the whole authority, and, for example, in a county council, might show that there is one highways division which requires major resurfacing works, the cost of which would take, say, 60 per cent of the county’s structural maintenance budget. The assessment system may rank these works as the highest priority in the county but it is unlikely that funds would be allocated in line with such an assessment since this would be seen as politically and administratively unacceptable. In practice, a proportion of the total budget will be allocated to each division or agent (often based on historical practice) and the jobs prioritised within the division. The present approach results in funds being spread too thinly over a number of competing types of maintenance, resulting in a gradual decline in the standard of the whole highways network.

GETTING THE WORK DONE

117. Most structural maintenance work is put out to tender and, while more of it could be subjected to competition, the first priority in many authorities is to improve their contract preparation and supervision processes. Authorities with good contract preparation and management procedures generally obtain better value for money from structural maintenance contracts. This requires tight control in drawing up specifications, contracts, and bills of quantity, good site supervision and record keeping and good materials testing regimes. The fact that most structural maintenance contracts by their nature will be subjected to remeasurement of quantities and volumes only makes good site supervision and record keeping more important. The better authorities examined during the study had site supervision costs of around two per cent of the contract sum for maintenance contracts. For this, they were able to achieve adequate control and supervision of the work and generally lower unit costs.

118. Materials testing and quality assurance are also very important. The TRRL has shown that with reconstruction, resurfacing and overlay works if the macadam or asphalt materials are compacted at a rate which is 10 per cent below specification, then the life of the material is shortened by 30 per cent. If there is little or no materials testing there must be concern about the quality of the materials received, although authorities rarely have the historic treatment data to establish the life of materials at any particular site.

119. The laboratory in one county visited during the study tests proprietary and new surfacing materials with the objective of improving value for money in drawing up specifications. The regular testing regime has produced a climate in which contractors know they must be careful about contract compliance and that materials must meet specification.

CONTRACTS

120. Unless contracts, specifications, bills of quantities and schedules of rates are tightly drawn up and technically competent, they will be exploited by both private sector contractors and DLOs, with a high incidence of variations and claims, cost overruns and high unit costs. Contract and on site supervision levels are often lax on DLO contracts.
Reviews at one authority of contract outturn costs compared with tenders showed the outturn price of DLO contracts consistently ran at higher levels than those of private contractors (Exhibit 30).

A COMPARISON OF FINAL OUTTURN PRICE WITH ORIGINAL TENDERED PRICE

In this authority, DLO final costs more frequently exceeded the tender than did contractors' final costs.

Exhibit 30

121. At least one authority is experimenting with contracts based on performance specification rather than the traditional method of the authority deciding on what materials to use, how they should be applied, etc. With performance specification contracts the customer specifies what he wants the product to achieve, for example: "a road that will carry x thousand vehicles per day with a design life of 20 years at a cost not exceeding £y". It is then up to the contractor to meet the specification within the price. Which materials are used and how they are laid are of no concern to the customer provided that the finished product meets the criteria. However, effective guarantees over the life of the product are of paramount importance with this type of contract.

122. Some authorities still put work out on a day works contract where payment is on a time and materials basis. Dayworks are much less satisfactory than a schedule of rates or spot tenders, both of which give a fixed price for a job. Authorities still using dayworks contracts should try to reduce their dependence on them.

COMPETITION

123. Highways maintenance is subject to the requirements of the Local Government, Planning and Land Act 1980. Among other things, this specifies that all jobs of work the value of which is above a specified threshold (currently £25,000 but previously £50,000) should be put out to competitive tender, as well as a certain proportion of other jobs.
(previously 30 per cent but from April 1988 the proportion is increased to 60 per cent). In most highway authorities, the method of satisfying these requirements has been to put major structural maintenance out to tender, while awarding jobs such as patching, potholing, footpath work and most routine maintenance to the DLO.

124. As the companion report on the national picture showed, some DLOs have been able to operate until recently with less than 10 per cent of their work won in competition. There were a number of ways in which the parent authority could exercise bias in favour of its DLO. For example, one county asked its DLO and contractors to price a schedule of rates (i.e. predetermine the price for a range of commonly occurring jobs). In practice, almost all the work was awarded to the DLO and the schedules were only compared at the end of the year. If the DLO's price for a schedule item was less than the lowest contractor's, then the DLO was declared to have won the work in competition. (This is contrary to the DLO regulations, since the DLO was never at risk of losing the work.) If the DLO price was higher then the work was treated as part of the work which could be awarded to the DLO as of right. The county has now ceased this practice.

125. Many authorities seek labour only tenders for surface dressing, and purchase the materials (oil-based binders and chippings) themselves. This may wittingly or unwittingly give an advantage to their DLO in tendering for the work, since most of the major contractors in the field are subsidiaries of the companies which supply the oil-based materials and they are not necessarily interested in labour only contracts.

126. Authorities should ensure that their tendering procedures do not favour their DLO. The Commission believes that an efficient DLO, tendering for most of its work, can be a most effective way of ensuring genuine competition among private contractors. The highways models* seem to demonstrate that DLOs can be as competitive as private contractors for this work (Exhibit 31). Equally significantly, the tender prices submitted by contractors to those authorities with efficient DLOs were often among the lowest. The contractors' tendering strategy to authorities with inefficient DLOs seems to vary from submitting low tenders in an attempt to embarrass the authority into awarding them the work, or high tenders on the principle of charging what the market will bear.

UNIT COSTS

127. Because of the justifiable variation in specifications for structural maintenance works such as reconstruction and resurfacing, it is more difficult to compare unit costs for this work than it is for routine maintenance activities. To overcome this, the Commission devised a series of realistic jobs which might commonly occur in every highways department and then asked authorities to price them as though their DLO or a contractor was bidding for the work. These 'highways models', as they were called, allow a consistent comparison to be made between the prices paid by different authorities. Broadly speaking, they show that for structural maintenance the range between the lower and upper quartiles (the most economic and least economic quarter of authorities) is about 1.3 to 1. This is a less wide range than has been encountered with other services and is consistent with a reasonable proportion of structural work being subjected to competition from national firms. The range between the most and least economic 10 per cent of authorities is of course wider at about 1.6 to 1 (Exhibit 8).

* See paragraph 127 for further explanation of the highways models
A COMPARISON OF THE PRICES CHARGED BY DLOs AND CONTRACTORS FOR THE SAME JOB OF RESURFACING AN UNCLASSIFIED ROAD USING A PAVING MACHINE

DLOs can be as efficient as private contractors

PERFORMANCE MONITORING

128. The standard of performance monitoring of structural maintenance is highly variable. Almost without exception, authorities monitor their expenditure against budget but very few attempt to monitor the volume of work achieved against what was intended. Thus most could say that they spent £x on surface dressing and how this compared with budget, but few could say whether or not they had achieved the intended treatment of y thousand square metres. The study did not find one authority doing this type of performance monitoring. It did find examples where authorities had spent the funds allocated to, for example, resurfacing but had not achieved the overall length of resurfacing required. The areas of work not done in one year were having to be carried over into the following year’s programme. This was then exacerbating the overall decline in the condition of the road network. Failure to achieve programmes can be due to unforeseen physical difficulties outside the authority’s control such as poor ground conditions. However, those cases found during the study were due mainly to poor or non-existent site supervision, with cost overruns consuming the budget before all the work was completed.

129. The study also found few instances of a centrally provided costing system which the highways department considered adequate for its purpose. Most highways

Source: Audit Commission highways models

Exhibit 31
departments have an in house system of their own often running parallel to one provided by a finance department. The reasons normally given are the inadequacy of the information provided by the central system, the unsuitability of the format in which it is provided, or the time taken to produce it. Indeed, the study found one authority where the cost ledgers took 12 weeks to produce, rendering them useless as a cost control system.
4. Appropriate Management Arrangements

130. The job of managing highways maintenance involves the client side tasks of formulating policy, assessing needs, securing funds and preparing budgets for each main function, commissioning work, supervising the DLO or contractor undertaking the work and monitoring performance. These themes have been discussed individually in the preceding chapters, and in this chapter we look at the organisation of client side management, the number of staff required and — a particular issue in counties — the agency arrangements with districts.

SPLIT BETWEEN CLIENT AND CONTRACTOR ROLES

131. The primary role of the local authority is the client side task, i.e. deciding what work needs to be done, specifying it, arranging for the work to be undertaken and then supervising it. The local authority may also undertake work itself via its DLO if that is the most economic and effective way of getting it done, but the contractor role should not become blurred with the client role. We have found counties where the divisional surveyor has both client and DLO responsibilities. This can place him in an awkward position in supervising the DLO and in situations where a choice needs to be made between DLO or contractor. Most of the examples of prejudice in favour of the DLO occurred in authorities where the client/DLO split was not a clean one. Officers should have clear client or contractor roles with no overlap of responsibility. It should be possible to achieve this in all but small agent authorities.

132. A clean split between DLO and client removes one of the barriers to more flexible budget allocation, since the demands of the DLO no longer dominate the decisions. This does not mean, however, that the DLO can be treated in exactly the same way as any private contractor, because it is unable to seek work outside the public sector and authorities need to retain the capability to carry out emergency work.

STAFFING

133. Authorities will have to review their client side staffing both for overall numbers and for relevant skills. The Commission's study suggests that sufficient numbers of staff are already employed nationally. However, they are not necessarily in the right places or employed in the right disciplines, and it is not always possible to redeplo staff from one discipline to another.

134. The Commission reviewed client side staffing levels in 36 authorities as part of this study. Fifty per cent of these authorities have between four and six full time equivalent (FTE) staff per £1 million of maintenance expenditure (Exhibit 32). Although this is only a broad indicator the study found that generally those authorities with less than four FTEs/£1 million had insufficient staff resources to run effective highway maintenance operations and those with more than six FTEs/£1 million were potentially...
over-staffed. Some of these authorities, however, were in the midst of developing highways management systems or large-scale inventory data collection which would justify greater staffing levels for a while.

**HIGHWAYS MAINTENANCE: CLIENT SIDE STAFFING LEVELS**

Maintenance staffing per £1 million expenditure varies by about 4:1 in authorities which suggests that staffing levels often bear no relation to workload.

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In 1986 the County Surveyors' Society carried out a survey into the number of additional client side staff required to meet the enhanced competition requirements. The survey showed that in 1985–86 over 98 per cent of highways maintenance jobs by number, but only about 60 per cent by value, were undertaken in jobs priced at under £25,000 each, and therefore not at that time subjected to full competition. In fact about two-thirds of this work was awarded to the DLOs without competition. The changes in the threshold levels of the Local Government, Planning and Land Act 1980 will require competitive tenders for most of the work undertaken. In a typical county, the study forecasts that these changes will require around three additional staff for contract preparation and administration. Indeed, the client side of large authorities should be able to take the changes in their stride once the mechanisms for enhanced competition have been established. For small authorities, however, the changes may mean a radical alteration to their systems and approaches.
136. These forecasts differ from those made by the respondents to the County Surveyors' Society questionnaire, who estimated that the number of client side staff engaged on tendering, contract supervision and administration would have to double in order to service the then proposed reduction in threshold and increase in proportion put out to tender. However, there is cause for scepticism about the basis on which these forecasts were made. Some ignored the fact that many small jobs will be let on a schedule of rates basis, whether the DLO or a contractor does the work. Some of the forecasts allowed for additional inspectors to be employed to supervise contractors, in the belief that private contractors require more supervision than DLOs. The special study has suggested that DLOs and contractors require similar levels of supervision and that current levels are often inadequate. It is appropriate that authorities should enlarge their supervisory staff, but misguided to attribute this as a cost of competition.

137. The study team's investigation of the County Surveyors' Society questionnaire suggests that the cost of additional staff to look after enhanced competition would be less than five per cent of the potential savings identified by the study, for which competition is an important catalyst. More competition should bring considerable net benefits to highway authorities.

AGENCY ARRANGEMENTS BETWEEN COUNTIES AND DISTRICTS

138. Agency needs to be better managed if the improvements discussed earlier are to be realised in county councils. The Commission's recommendations on how this should be done are given in detail in Chapter 3 of its report Improving Highways Agency Arrangements Between Counties and Districts. That report calls for a more accountable and contractual approach to agency, similar to the way in which the DTp and Welsh Office manage their trunk road agencies with local authorities.

139. This approach is summarised in Exhibit 33 and is underpinned by the budget setting and performance monitoring cycle shown at Exhibit 34. Under this, the county council as highway authority sets policies, standards and priorities, after consultation with its districts, both agent and non-agent. The county council then allocates resources in line with policy and standards, using unit costs, inventory and road condition data. The county and district officers then deliver services in line with policy. Officers at county HQ monitor and review performance. They apply similar criteria, agents' performances are assessed in a similar way to the county's own employees (divisional surveyors, etc), and rely upon standard reports, exception reports and sample technical and financial audits rather than 100 per cent supervision. The information they obtain is used in the next year's policy and budget setting discussions.

140. The approach requires a change in the way in which district councillors approach maintenance agency. They should concentrate upon initial policy discussions with the county and limit their involvement in day to day service delivery to those matters explicitly allowed by the agency agreement. Better information flow and cooperation between counties and districts are also needed; counties should provide agents with adequate administration fees which cover the costs of information processes and agents' other costs — dealing with the public, supervising contractors, etc.

141. Such actions can be taken by local authorities. The ultimate responsibility for the current problems with agency does not lie with local authorities; rather with the fudged and unsatisfactory legislation they have to work to. The Commission's interim
## Control Policies

County council, as highway authority, is in control and makes final decisions.

County council develops policies, priorities and standards after consultation with agent and non-agent districts.

County council defines frequencies of service for cyclical maintenance; response times for emergencies, winter gritting etc.; intervention levels for structural work.

Budgets allocated with the help of objective assessments of need.

County council defines frequencies of service for cyclical maintenance.

Regular condition surveys carried out to help with budgeting for cyclical work.

County and agent officers provide services in line with county council policy.

County council defines virement rules etc. Agents and county officers with similar responsibilities enjoy similar freedom of action.

County council does not penalise success; agents and areas/divisions providing the specified service, within budget, allowed discretion on how to use the remaining funds. Agents' members do not become involved in current year service provision, except where the county has granted discretion.

County council defines, in advance, the performance it expects from agents and from its own areas/divisions, applying similar criteria to both.

County council carries out sample based financial and technical audits of agents; it does not attempt 100% supervision.

County council funds inventory and condition systems (possibly financing initial data collection for inventories as a 'one-off').

Agency administration fees cover the costs of providing management, financial and performance data (eg. a 10% fee, or separate data collection flat fee plus a, lower, works supervision percentage).

Fees also cover reasonable local accommodation costs (eg. by comparison with costs of education or social services offices in the agency area).

County and district officers consult on technical matters of mutual concern – efficiency, effectiveness, working methods.
report recommended several changes in the law which would improve the definition of responsibilities and provide a better framework for cooperation.

142. The Commission has received a number of responses from the Local Authority Associations, professional bodies and individual authorities, listed in Appendix 3. The ADC commented that it had reservations about the sample of authorities studied, but that:

"It is hoped that this fresh study of the subject will prove helpful and lead to improvements. In particular the Association welcomes the acknowledgement contained in the Report that agencies can work efficiently. However, it is disappointing to note that the Report has not given more attention to the wider range of agency functions... The Association will try to work as far as possible with the ACC to agree on aspects of the report on which progress can be made to bring about savings and improve efficiency..."

The ACC has also commented:

"The Association therefore hopes that Ministers will take an early opportunity to endorse this key recommendation by introducing legislation to repeal Section 42 thus creating the best legal framework in which counties and districts are to operate to provide the most cost effective service to the public."

143. The Commission sees no need to alter the recommendations in the interim report. The points of substance raised in response to the interim report were all about issues which had been examined during its research, while its findings and conclusions have been supported by those parts of its overall highways study completed since its interim report was published. However, the urgency of the changes in law advocated by the Commission has increased. The extension of compulsory tendering required by the Local Government Act 1988 highlights the disadvantages and difficulties created by overlapping street sweeping and grass cutting responsibilities, while the exercise of Section 42 rights could also create difficulties when long term contracts have already been let by a county.

144. Auditors are now examining highways agency in individual counties. The Commission hopes that this work will be of assistance to authorities in improving their agency arrangements. Local solutions to agency problems are required rather than national discussions on codes of practice. As with all value for money reviews, the Commission will examine the local audit reports once they have been completed and may comment on the main findings in a subsequent annual report, or elsewhere, but it does not plan a further report exclusively devoted to the agency issue.
THE BUDGET SETTING AND PERFORMANCE MONITORING CYCLE FOR HIGHWAYS MAINTENANCE

Districts and counties should collaborate on budget setting and performance monitoring.
5. What Needs To Be Done

145. This report and its companion have identified a large number of ways in which highway authorities could improve the way they manage highways maintenance. Central government could also make improvements to the laws within which authorities work, and continue its support for improved technical approaches and systems. This chapter summarises the main actions required.

**ACTION BY CENTRAL GOVERNMENT**

146. Central government should recognise that local authorities will not be able to achieve efficiency improvements overnight; a period of at least five years will be required. It should maintain the current enhanced provision for highways maintenance until the deterioration in roads has been halted and highway condition stabilised for at least three years. In the future, changes in provision should be made gradually because it is difficult for highway authorities to respond immediately to significant changes.

147. So that the increased expenditure is not dissipated on maintaining less important roads, consideration should be given to clarifying the law to make it clear that different standards of road condition should be expected on different types of road. Some poorly used minor roads may have to become, in effect, green lanes, where the volume of traffic cannot justify a higher standard of road.

148. The DTp and Welsh Office should continue to support computerised highways management systems, in particular RMMS and PMS, and should encourage local highway authorities to extend such systems to their own roads. The DTp should encourage the TRRL to extend and speed up its research into whole life costing of roads, and should support the research being undertaken by certain universities (Newcastle and Nottingham) into road design and road track costs. They should also follow up the recommendations of the National Audit Office in their 1987 report Department of Transport: Regulation of Heavy Lorries. This report says that if better suspension systems were developed and fixed to all heavy lorries savings of about £100 million a year in road maintenance could be achieved.

149. If the opportunities identified by the study are to be realised fully central government will need to make the following legislative changes:
- repeal Section 42 of the Highways Act 1980;
- act on the review of the Public Utilities Street Works Act 1950;
- make district councils responsible for all highways cleansing and urban grass cutting;
- make county councils responsible for all street lighting.

**ACTION BY LOCAL GOVERNMENT**

150. Local authorities need to take a more strategic view of maintenance and adopt many of the policies and methods now being implemented by the DTp and Welsh Office. To begin with, authorities should determine the budget needed to maintain local highways in a satisfactory condition. Before this can be achieved they must establish up to date
inventories, install a system of regular road condition surveys and develop explicit policies on maintenance. Budget allocation procedures will need to be revised. At the same time as these procedures are being introduced or revised, the day to day management of highways maintenance needs to be reviewed; in particular, agency arrangements, staffing levels, and tendering arrangements.

UP TO DATE INVENTORIES

151. The lynchpin of improving local authority management is the possession of an accurate and up to date inventory of the network and what is on it. The scope and detail of the inventory is partly a matter for local choice but the Commission recommends that it should include the items listed in Exhibit 16. The installation of the DTp’s RMMS on trunk roads and motorways seems the ideal opportunity for highway authorities to extend the exercise to their own roads and for them also to consider highways management systems of the type described in Appendix 2.

NEEDS ASSESSMENT AND CONDITION SURVEYS

152. Highway authorities should move towards needs assessment as the basis for routine maintenance activities, and condition surveys as the basis of structural maintenance activities. In both instances, the LAA or DTp Codes can be used as policy guidelines but each highway authority should assess its own needs and the condition of its own network. Ways in which this can be done include extending the NRMCS data collection points and by using CHART, MARCH and SCRIM augmented by deflectograph surveys. If this is done in a planned and statistically representative way each authority will be able gradually to monitor the condition and residual life of its network. The completion of the DTp’s pavement management system (PMS) will give an opportunity for highway authorities to apply that system to at least their principal roads.

153. With winter maintenance salting activities, authorities need to ensure that their turn outs match the conditions and that roads are not salted unnecessarily or go untreated when they should have been. Therefore they need to be sure that the information on which the decision is based is the most accurate available and is received at the right time of day.

EXPLICIT POLICIES

154. Local highway authority members should see it as their prime responsibility to formulate policies on maintenance, taking into account their local circumstances and the published codes. Counties should consult all their districts before formulating policies, but then ensure that agents are adhering to their policies within the discretion granted. Firstly, the members should initiate a review of the frequency of routine maintenance to see whether scope exists for reducing the frequency of some activities. In some authorities, the scope may be limited, but every authority should examine its frequencies critically and test the effect of reductions by, for example, a pilot trial in one particular area. The Local Authority Associations’ Code of Good Practice will serve as a useful guide to likely frequencies although lower frequencies may also be adequate. Members should also ask officers to review the intervention levels for structural maintenance, such as the height of a footpath trip which requires repair, minimum kerb height etc. Again, the LAA Code provides a benchmark.
REVISED FINANCIAL PROCEDURES

155. Authorities need to give careful consideration to their spending levels compared with their GRE for highways maintenance. The GRE is a useful proxy for what the government considers each local authority should be spending. The Commission's study suggests that, if each authority in 1987–88 had spent 107 per cent of its GRE allocation on maintenance, the deterioration in road condition should have been halted. Some authorities appear to have constrained funds for highways maintenance rather than face politically charged decisions about school closures and the provision of social services. With accurate inventories and information on road condition, highway authorities can determine the required level of funding and not rely on GRE as a proxy.

156. Budget allocations should be based on inventories, unit costs and frequencies for routine maintenance, and on highways condition for structural maintenance. Unit costs and schedules of rates are needed for this. The changes in allocation to different areas may be politically uncomfortable in the short term. For example, it may be necessary one year to concentrate more of the budget on one activity or in one area.

GETTING THE WORK DONE

157. Chapter 4 emphasised the need for a distinct split between the client and contractor roles within the authority, with no dual hatted staff below chief officer except possibly in small agent districts where such a split might not be practicable. It is also essential to have a strong principal/agent relationship between counties and districts. The county must set the policy, the agent must deliver the service and the county must carry out financial and technical audits to see that it does. The county should, however, allow the agent to get on with the job without involving itself in the day to day running of the agency.

158. All authorities should review their client side staffing levels in the light of the local audit findings, and ensure that they are adequate for running highways management systems, administering a high proportion of work put out to tender, undertaking adequate materials testing and supervising DLOs and contractors on-site.

159. Before awarding work to either a DLO or a contractor, an authority should ensure that the price being charged is competitive, either by obtaining several tenders for the work, or, occasionally, by other means. It is not good practice to award entire categories of work without competitive tender, whether to a DLO or private contractor.

160. The recent CIPFA publication The Extension of Compulsory Competition - Meeting the Challenge, identifies the key issues authorities should be addressing to make their DLOs more efficient. For example, methods of working and bonus schemes in the DLO should be reviewed as a matter of priority. The Commission recognises the case for a viable DLO, both as a safeguard against possible price rings by contractors and because of the convenience of using direct labour for many of the frequent, but small jobs and emergency work. But the case falls away if the DLO is not competitive. It is important that local authority direct labour organisations make themselves competitive with private sector firms. Without this, and with the central government legislation on increasing competition, local authorities could find themselves a captive market for the private sector. This could be as damaging and costly as the current practice in some authorities of inefficient DLOs ‘winning’ work through various manipulations in tendering arrangements or by simply being awarded work without competition.
161. Having decided what needs doing the authority must monitor the level of achievement. This requires the prompt provision of accounting information in a format which is suitable for cost control, plus good contract and site supervision and efficient materials testing regimes.

162. Exhibit 35 summarises the action required. If these actions are undertaken, the immediate effect should be to halt the deterioration in road and footpath condition. In the medium term, highway authorities should be able to allocate money for highways maintenance based on assessed need rather than the 'suck it and see' approaches of the past. It is expected that improvements in efficiency and effectiveness in the medium term will allow a diversion of funds from routine maintenance to structural maintenance. This will permit a slight reduction in total national provision for maintenance, while holding or even improving the condition of highways.
SUMMARY OF ACTION REQUIRED BY LOCAL HIGHWAY AUTHORITIES

Authorities should assess need, secure adequate funding and improve the day to day management.
APPENDIX 1: AUTHORITIES PARTICIPATING IN FIELDWORK FOR THE STUDY

Birmingham City Council
Blackburn Borough Council
Bradford City Council
Brentwood District Council
Cambridge City Council
Cambridgeshire County Council
Cheshire County Council
Colchester Borough Council
Congleton Borough Council
Crawley Borough Council
Cumbria County Council
Devon County Council
Dorset County Council
Essex County Council
Exeter City Council
Fenland District Council
Gloucestershire County Council
Hereford and Worcester County Council
Ipswich Borough Council
Lancashire County Council
Lincolnshire County Council
Lliw Valley Borough Council
Neath Borough Council
Oxfordshire County Council
Plymouth City Council
Port Talbot Borough Council
Richmond London Borough Council
Sandwell Borough Council
Solihull Borough Council
South Ribble Borough Council
Southwark London Borough Council
Stratford on Avon District Council
Swansea City Council
Thamesdown Borough Council
Torbay Borough Council
Vale Royal District Council
Walsall Borough Council
Warrington Borough Council
Warwick District Council
Warwickshire County Council
West Glamorgan County Council
West Sussex County Council
Wiltshire County Council
Worthing Borough Council
APPENDIX 2: HIGHWAYS MANAGEMENT SYSTEMS

1. Our research on highways maintenance showed that management information systems are an important issue. There are a number of developments in the field and the scene is changing fast. This appendix summarises our understanding of the state of the art.

THE STATE OF THE ART

2. A number of counties and consultants are developing systems for highways management. The long term objective is to produce a comprehensive system which will cover all aspects of highways management including inventories, treatment histories, programming of work, resource allocations, traffic modelling and design of schemes. All the systems are based on some form of digital model of the highway network and a detailed inventory. The structure of a typical system is shown in Exhibit A1.

STRUCTURE OF A TYPICAL HIGHWAYS MANAGEMENT SYSTEM

All systems are based on a digital model of the network and an inventory

Exhibit A1
3. One authority has identified the following functions which it would expect its maintenance management system to fulfil.
   a. *Environmental maintenance and safety maintenance*
      - Budget preparation and allocation
      - Programming, implementation and control of works
      - Monitoring of conditions, performance and policies
   b. *Structural maintenance*
      - Forward planning
      - Preparation of budget submissions
      - Countywide budget preparation and allocation
      - Programming, implementation and control of works
      - Monitoring of conditions and policies
      - Monitoring of treatment performance
   c. *Administrative systems*
      - PUSWA
      - Licences and permits
      - Drainage easements
      - Drainage networks
      - Street lighting cable records
      - Highway boundaries
      - Financial commitments

Another authority envisages its system will be used for: developing policies, allocating funds, ordering of work, planning and cost control, preparation of contract documents, payment for work, understanding changing volumes of demand, adoptions, design and traffic management.

THE COSTS OF A MIS FOR HIGHWAYS

4. The main elements of cost associated with a Highways Management Information System (HMIS) are:
   a. Digitising the inventory data;
   b. Collecting the inventory data;
   c. Developing the software and acquiring computer hardware where necessary;
   d. Updating the inventory and maintaining the systems.

The earlier stages can be costed with some precision but any estimates of the maintenance costs can only be tentative.

DIGITISING THE NETWORK

5. A digital model of the highway network is the basis for any HMIS. A basic digital model does not involve major investment. Several companies will digitise road centre lines from Ordnance Survey maps by scanning for around £150–£200 per sheet. It is costing one
authority £25,000 for 4,200 kilometres and it cost another county one man year to cover 5,500 kilometres. There may well be scope to share this cost with other departments in the authority, such as police authorities and property departments.

6. The nature and precision of the locational referencing system chosen is a critical factor in determining the flexibility of the data for the future analyses. Different referencing systems are suited to different purposes. The only effective way of cross referencing spatial data is by using the smallest practical spatial unit.

7. Many highway authorities favour the system used by DTp for RMMS. This is the CHART system enhanced with cross-sectional location codes and with the nodes cross-referenced to Ordnance Survey Grid References (OSGR). This appears to be an acceptable approach. The cross-referencing of the nodes to OSGRs is essential; software is available to match a network so defined to OS maps.

COMPILING THE INVENTORY

8. Along with the digitised network, an inventory of highways items forms the heart of the system. It is important that authorities assess what they need to know and why and then tailor their inventory collection accordingly. The cost structure is such that it would be considerably more expensive to have to tour the authority a second time to collect further items than to capture all the data on the first pass. Whilst the collection (and updating) of data which is of little or no use is clearly a waste, it appears that the marginal cost could be small.

9. Hertfordshire County Council considered in great detail what they needed to know. They also constructed marginal cost curves for estimating the extra time required to collect additional details (see Exhibit A2) as part of a pilot study for the TRRL. They settled for 36 items. The DTp's RMMS requires 44, the Northern Ireland Office is collecting around 50 items on all roads. Another authority is collecting 76 items including a number of items not directly associated with highways management at the request of the district councils. The special study did not find any authority which had taken the view that they needed to collect detailed information about their more important roads but less on minor roads. Two reasons advanced for this have been that if the information is to be used for budgetary purposes then it needs to cover the entire road network; and there will be a lower cost of updating the data on minor roads because changes occur less frequently. These arguments do not seem wholly convincing but no authority has taken the more hierarchical approach.

10. The surveyors working in one authority cover approximately two kilometres a day in urban areas and four kilometres a day in rural areas. They work in pairs and log the data on Husky Hunter portable micros. The surveyors working in another authority have covered 2.5 kilometres per day in urban areas, again working in pairs with Husky Hunters. A reasonable guideline for inventory collection is around £50 per kilometre although urban areas will be more expensive than rural areas because of the greater prevalence of inventory items.

SOFTWARE DEVELOPMENT/HARDWARE REQUIREMENTS

11. One county’s system has cost £500,000 over a three year period, with a substantial amount of development work remaining. Another county still has a long way to go in developing its systems but there are up to five or six programmers and two system analysts
involved at any one time; there is also a project team of four officers within the highways department. There will be several systems becoming available during the next couple of years, however, and there should be considerable scope for purchasing systems off the shelf. If should be possible to buy a micro based system for around £5,000 and a main frame system for around £100,000.

12. A group of counties called the Gateway Group has prepared a manual setting out principles and standard documentation to facilitate the exchange of highways management systems at three levels of development.

13. The DTp and Welsh Office are requiring all their agents to collect inventory data for motorways and trunk roads and to install their Routine Maintenance Management System (RMMS). Several groups of highway authorities who intend to use the same hardware and software for RMMS are forming. The DTp will contribute towards the cost of installing these systems which they hope authorities will extend to their own roads. In a recent survey completed by 75 per cent of highway authorities around a half of respondents envisaged extending RMMS to their own roads.

14. The DTp is going to assist authorities with the set up costs and hardware acquisition if necessary. Clearly it is important that any authority acquiring hardware to run RMMS considers its own requirements at the same time. Whilst micros will generally be sufficient for the DTp's roads in a county, at the current state of technology they would
only be adequate for the local authorities' own roads in the smaller metropolitan authorities. Authorities need to bear in mind the possibility that, in the longer term, the market may not be able to support a large number of systems. Clearly the cost of having to transfer to another system after a few years could be considerable.

15. The DTp is also commissioning a feasibility study and system specification of a structural maintenance system (PMS — Pavement Management System); this is to be financed 50-50 by DTp and the LAAs.

UPDATING THE INVENTORY

16. Updating the inventory can take one of two forms (or a combination of them both). Either an attempt is made to record all changes as they occur or there is a major revision every five years or so. The consensus seems to favour a continual update on the grounds that the alternative would result in the inventory falling into disrepute. However, the difficulty of capturing all changes in this way should not be underestimated and there must be a danger that a major revision exercise would still have to be undertaken every few years.

17. One county estimated the annual cost of the central updating control team at about £60,000. Another county originally envisaged that updating would occur in two ways:
   i. As part of an inspector's normal inspection duties;
   ii. Automatic updating by data transfer from other parts of the highways management system.

Their estimate of the cost attributable to updating the inventory in this way was £33,000 for a much smaller network than the first county. A third county did not maintain their inventory on rural roads for five years and is now engaging three people for nine months each to bring it up to date. It may be that the best approach would be a continuous update in urban areas plus a periodic (say one to two years) patrol in rural areas, combined with an audit every, say, seven years. As a guide this is likely to cost £5 to £7 per kilometre per year.

A STRATEGY FOR INTRODUCING THE HMIS

18. A comprehensive HMIS will be a large and complex system. It is crucial that a strategy is developed for introducing the system. One county has given some thought to this matter. Their first target has always been to base the 1988-89 budget on the inventory. This meant they had to collect the inventory data in 15 months which they are on target to achieve. They specified tight data validation procedures in the tender documents and after the initial couple of weeks’ learning period they have achieved good levels of accuracy. They consider their validation requirements to have been an important aspect in ensuring they obtain what they want when they want it.

19. This represented a tight timetable for data collection, which influenced their decision to use consultants. The other considerations were the need for consistency across the county, and a doubt as to whether the district councils would have the resources or expertise (against this was the advantage of gaining the districts’ commitment if they had been involved in the data collection). In the event they obtained an extremely competitive bid from a contractor.

20. The next stage will be to extend the system to cover preparation of bills of quantities, work programming and scheduling, monitoring, route planning, etc. The administrative systems, traffic modelling, etc will be introduced over the next few years.
21. This authority is making interim arrangements for structural maintenance pending the advent of the DTp's PMS. It is hoped that a workable version of PMS will be available by mid 1990. However, there is plenty of groundwork that most authorities will need to do before they are ready to take PMS on board and the timing of this should not inconvenience them greatly. We would recommend, therefore, that authorities wait for PMS to become available to fulfil their needs on structural maintenance and put their efforts into preparing themselves for its arrival.
APPENDIX 3: COMMENTS RECEIVED IN RESPONSE TO THE COMMISSION'S INTERIM REPORT IMPROVING HIGHWAYS AGENCY ARRANGEMENTS BETWEEN COUNTIES AND DISTRICTS

The Commission has received written comments on the report from:

- The Association of County Councils
- The Association of District Councils
- The Association of London Borough Engineers and Surveyors
- The Borough Engineers' Society
- The Society of County Treasurers
- Avon County Council (Planning, Highways and Transport Committee)
- Cleethorpes Borough Council
- Councillor M F Odling (Chairman, Development, Planning and Transportation Committee, Kent County Council)
- Shrewsbury and Atcham Borough Council
- Watford Borough Council
- Wrexham Maelor Borough Council
- York City Council (Traffic and Transportation Committee)

The report has also been the subject of a seminar at the Institution of Civil Engineers ('The Audit Commission's Report on Highways Agency — can we make it work?', 9 February 1988) attended by over 150 officers from counties and districts.
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