National Roads in England: The Code of Practice for Routine Maintenance

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ABSTRACT

Road maintenance on national roads in England is divided into three general categories--structural, routine, and winter. The operational management of structural and winter maintenance is now well established, mainly because of the high cost and relative importance attached to those areas of activity. Less attention has been paid to the regulation of routine maintenance operations even though the need for consistency across the network is at least as important in this category as it is in the other two. Routine maintenance includes a wide range of different activities, and it was concluded that the best way to achieve a consistent approach would be to produce and implement a code of practice that would set out the procedures for and frequencies of inspections to determine what routine maintenance tasks need to be carried out and, in the case of cyclic operation, the frequency of execution and in some cases the manner in which they are to be performed. The code not only provides a fixed basis for the implementation and management of the work but also, in association with highway inventory data, provides a firm base for the allocation of funds for routine maintenance operations related to need rather than to the financial resources available. The historical background to and the justification for the code of practice are given and its scope, the preparation work involved, its contents, the peripheral management procedures brought into use with the implementation of the code, and the manner in which these relate to the component parts of a maintenance management system are described.

Responsibility for the construction and maintenance of roads in England is divided between central and local government. Central government (through the Department of Transport) is responsible for the national, strategic roads--motorways and all-purpose trunk roads. Local government is responsible for all other public roads.

There are 2260 km of highway in England and 7770 km of all-purpose trunk road. Together they represent only 4 percent of the total road network but provide for about 25 percent of the country's road travel and about 50 percent of all heavy-goods-vehicle movements. The remainder of the network is made up of more than 250 000 km of principal interurban, urban, and local roads, which are the responsibility of 78 local highway authorities. Most of those authorities also act as the Department of Transport's agents for maintaining the national network working under the department's instructions.

About £1.1 billion of public money is spent each year on maintaining the road network. Funds for highways and trunk roads all come from central government, whereas funds for local roads come from local authority resources assisted by central government grants.

Before 1970, maintenance activity had been allowed to develop in a somewhat haphazard fashion with the many highway authorities working to a wide range of standards, if indeed standards were set at all. Certainly, the department tended to concentrate on new construction.

The first major attempt to consider and make recommendations on the planning, execution, and control of highway maintenance in the United Kingdom was made by a committee set up in 1967 under the chairmanship of A.H. Marshall. The report of this committee (1), published in 1970, stressed the importance of assessing the condition of the road network against a set of objective standards, which should indicate what needs to be done and when in order to maintain structural integrity, safety, and amenity with the least expenditure of resources over the life of the road.

The department has a particular problem in the management and maintenance of the national road network in that it is substantially reliant on a large number of individual agent authorities. The individuality and comparative independence of these agents results in a wide divergence in both the rate of spending and in maintenance practices and this is particularly true of cyclic and routine maintenance.

One of the principles of the national road system is to achieve a uniform level of service for the road user. A local authority will make a judgment on the level of service required by the community that it represents and this is often different from that chosen by its neighbor. These differences are not compatible within the context of a national road system, and the department had to make its requirements clear to its agents. With these factors in mind the Secretary of State commissioned Inbucon Management Consultants Limited to carry out a study. Inbucon presented their report (2) in 1982, and three of the main recommendations called for

1. A code of practice for routine maintenance,
2. The setting up of operation reviews by some form of technical audit, and
3. Experimental pilot schemes involving the private sector.

The recommendations were accepted by the department, and work has been proceeding to implement them, with first priority being given to the code of practice.

OVERALL MANAGEMENT OF THE NATIONAL ROAD NETWORK

The department is developing a comprehensive maintenance management system (MMS). It has two parts: structural maintenance management (concerned with replacement and renewal of pavements and other highway infrastructure that have reached the limit of their service life) and routine maintenance management (concerned with work needed to keep partial highway items functioning satisfactorily). The first part is based on the use of structural and visual assessment techniques such as surveys by the deflectograph, the sideways force coefficient routine inspection machine (SCRIM), and computerized highway assessment of ratings and treatments (CHART). The second is based on the inspection and reporting procedures contained within the code of practice for routine maintenance and inventories of highway infrastructure. The whole will integrate with the department's highway database known as the network information system (NIS), which is being developed concurrently with the MMS. Figure 1 shows the relationship.

The maintenance budget for the national road network is some £200 million per year, of which £30 million per year is spent on routine maintenance work. Before the code of practice the allocation of funds for routine work was based on historical outturn costs.

ROUTINE MAINTENANCE OF THE NATIONAL ROAD NETWORK

It is difficult to give a precise definition of what constitutes routine maintenance because of the many and varied operations encompassed by the term. It is easier to define the general objectives of carrying out the work; these are

1. To ensure that the condition of the highway does not become hazardous to highway users or a hindrance to traffic,
2. To ensure that the aids to safety and movements within the highway function satisfactorily,
3. To help preserve the structure of the highway,
4. To protect adjacent land users from injurious damage and nuisance due to the presence and use of the highway, and
5. To protect the environment and preserve amenity.

The stated objectives are not solely confined to routine maintenance.

Table 1 lists operations classified as wholly or partly routine maintenance as related to the stated objectives. This clearly illustrates the value of what has been often regarded as a relatively unimportant part of the highway maintenance effort.

THE CODE OF PRACTICE

A reasonable boundary for routine maintenance can be defined as one between work that has to be carried out to keep a particular highway item functioning satisfactorily and work that is needed to replace the item when normal wear and tear has progressed to the point at which no amount of cleaning, patching, or damage repair will be effective. Table 2 defines this boundary for a number of maintenance examples.

The scope of the code of practice is based on a similar philosophy and deals with the short-term and cyclic maintenance necessary to keep the highway in good working order. It follows that it does not deal with long-term planned replacement or renewal maintenance, although the inspection requirements in the code may point to the need for such maintenance.

The main headings for the code are

1. Inspections for routine maintenance;
2. Minor highway repairs;
3. Footways and cycle tracks;
4. Covers, gratings, frames, and boxes;
5. Curbs, edgings, and preformed channels;
6. Highway drainage;
7. Fences and barriers;
8. Grassed areas;
9. Hedges and trees;
10. Sweeping and cleaning;
11. Road markings;
12. Road studs;
13. Road traffic signs;
14. Traffic signals;
15. Road lighting; and
16. Highway communications installations.

Preparation

The major part of the preparation for the code consisted of a series of fact-finding visits to agent

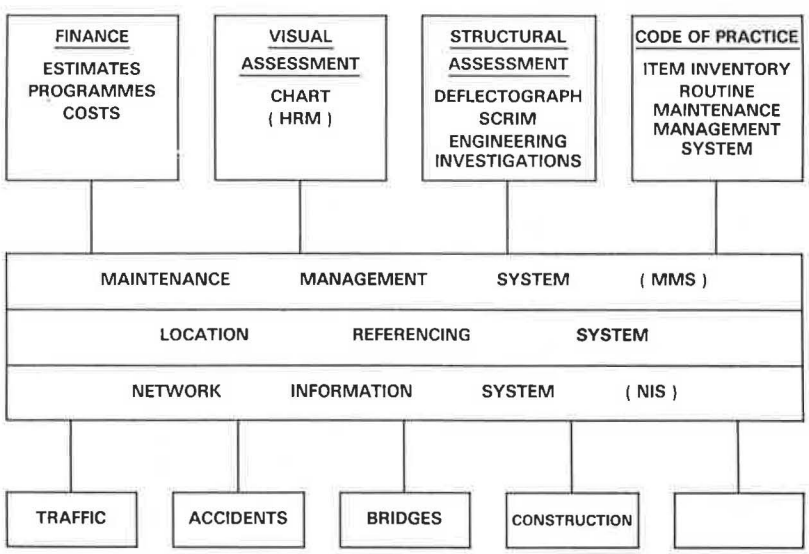

FIGURE 1 Relation between maintenance management system and network information system.

TABLE 1 Routine Maintenance Operations Related to Stated Objectives

Operation	Objective 1	2	3	4	5
Verge maintenance (grass cutting, weed control)	*	*	•	*	*
Sweeping and cleaning (highway) and footway sweeping, litter disposal, and debris removal (motorways)	*	•	•	*	*
Highway drainage (gully and drain cleaning, ditch clearance, grips, sewer maintenance)	*	•	*	*	•
Boundary fences, noise barriers, and hedges	*	•	•	*	*
Tree maintenance	*	•	•	*	*
Safety fences and barriers	*	*	•	•	•
Traffic signs (maintenance and cleaning)	*	*	•	•	•
Road markings	*	•	*	•	•
Patching and other minor highway repairs	*	•	*	•	•
Footway maintenance (excluding major reconstruction)	*	•	*	•	•
Ironware on highways and footways	*	•	•	*	•
Curb maintenance	*	•	*	•	•

Note: * = wholly routine maintenance; • = partly routine maintenance.

TABLE 2 Maintenance Boundaries

Maintenance Example	Routine Work	Replacement Work
Reconstruction	-	Complete replacement
Overlay	-	Complete replacement
Resurfacing	-	Complete replacement
Surface dressing	-	Complete replacement
Minor highway repairs	Isolated potholes and dangerous areas	Larger patches over a length of road
Drainage	Isolated repairs to pipes, filter drains, manholes, grips, ditches, etc.	Replacement of lengths of old pipework and filter drains
Footways, etc.	Isolated potholes and other dangerous areas	Large-scale replacement or resurfacing of footways
Safety fences	Repairs of damaged safety fences	Large-scale replacement to accommodate new road levels or when steel work corroded beyond effectiveness
Boundary fences	Repairs of damage caused by stock, vandals, vehicles, etc.	Large-scale replacement of fences at end of useful life of timber
Verge maintenance	Grass cutting, weed control, hedges, and trees	-
Sweeping	Channel sweeping, litter, etc.	-
Drainage cleaning	Gully emptying, grips, ditches, pipe-rodding, etc.	-
Signs	Cleaning, repair, and replacement due to isolated damage	Replacement due to fading and loss of reflectivity (usually on a length of road)
Road markings	Isolated replacement of cat's-eyes and locally worn-out lines	General replacement of worn-out markings

authorities. The intention was to establish the range of existing practice and to find objective evidence justifying its need and measuring its effect.

It soon became apparent that little work had been done to establish the effectiveness, including the cost-effectiveness, of any of the various practices. Generally standards and practices appear to have evolved as a result of financial factors and locally determined priorities rather than through conscious development. Many of the practices were found to be subjective in application and did not point clearly to individual standards that should be adopted. Certainly the variation between the standards and practices of individual agents was often found to be considerable.

Following the investigation, the code was prepared on the basis of the department's own assessment of the standards of routine maintenance that should be applied to the national road network. It will be necessary to monitor the effects of adopting the code over time to determine its appropriateness and cost-effectiveness and to modify it as necessary.

Inspections

Considerable emphasis is placed on the need for formalized inspection systems that use a standard inspection report and action form. Two types of inspection are called for--safety and detailed. The safety inspections are designed to identify those defects likely to cause a danger or serious inconvenience to the public and that therefore require immediate or urgent attention. The detailed inspections are designed primarily to establish programs of routine maintenance tasks and are more activity-specific than safety inspections. Required frequencies for both types of inspections are specified.

Within each area of maintenance activity, defects are defined as either Category 1, which requires urgent or short-term attention, or Category 2, which requires less urgent, longer-term attention. Guidance is given on the scale of defects to be noted and dealt with. Response time requirements for dealing with defects are also given.

Figure 2 shows an operational flowchart for the code.

Monitoring

As explained earlier, the code is at this time imperfect in absolute terms. Also, national standards cannot cover special local requirements. Thus there is provision for controlled variation to fine tune the requirements. The inspection systems will assist in identifying need for both local and national variations. Monitoring is necessary to provide verification of the requirements, and a procedure will be established that will identify where changes need to be made. It is expected that limited revisions will take place from time to time.

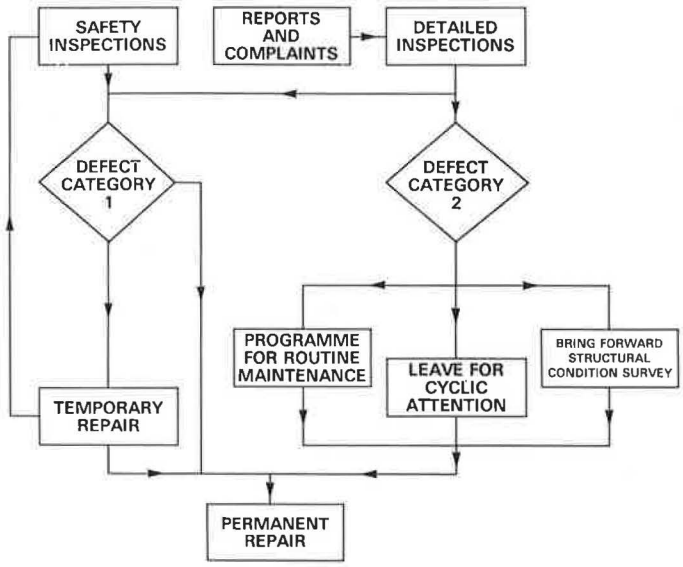

FIGURE 2 Operational flowchart for code of practice.

Application

The code of practice is essentially a working management instruction from the Department of Transport to its agents for the routine maintenance of the national network. The code also provides a firm basis for the allocation of funds and assessment of performance.

IMPLEMENTATION OF THE CODE OF PRACTICE

At an early stage in its production it became clear that the success of the code would depend on the use of efficient and effective arrangements for storage and retrieval of information on the defects, inspection, and remedial action. These arrangements are also the vehicle for translating the policy contained in the code into a detailed working management system.

Information Storage and Retrieval

Before the form of the information storage and retrieval arrangements was considered, it was necessary to define the environment within which these would operate and the objectives to be achieved.

The appropriate environment is considered to be an extension of the existing one by which an agent carries out the management of routine maintenance operations on behalf of the department. Under the code this situation will continue but provision is also needed to make more use of the private sector in carrying out routine maintenance work. In all cases future routine management will be regulated by the code of practice. An assumption was made that, initially, the system would need to be a manual one based on paper files, which, once suitable software became available, could then be computerized.

The objectives to be achieved by the system are to provide checks on compliance with the code; to identify instances in which difficulty is being experienced in meeting the national standards (and thus there is need for local or more general variations to the code requirements); to allow comparisons to be made with other standards, such as those adopted by local authorities; and also generally to provide management information on routine maintenance operations.

The specific requirements of the code also have to be considered, that is, the two different types of inspection (safety and detailed) in 15 different areas of routine maintenance. The manner in which the inspection is initiated needs to be recorded as well as the date, time, and location; the action taken or proposed; and the cost.

Using the Inspection Record

Trained personnel carry out inspections and a single inspection record is completed for each defect found, which is subsequently used to record the action taken and its cost. The form of the inspection record and the requirements of the code impose a discipline and a method of working on the users.

Following inspections the completed records are returned to a central location within the agent's organization for processing. Those responsible for managing routine maintenance programs review this information on a regular basis to determine where action is outstanding and to prepare work programs. By identifying the type of defect and the date of inspection it is possible to determine the time scale within which remedial action must be taken.

Monitoring Performance under the Code of Practice

Agents are setting up systems within their own organizations that comply with the requirements of the code and also the reporting requirements of the department. The department will not have direct access to the actual information but will request performance checks from time to time. These will be for particular problems and more formally under a system of technical audit.

The type of information sought will be the extent to which the code is being adhered to; identification of difficulties in meeting the standards set out in the code; and information on individual defects, the time between inspection, and remedial action.

Spot checks on the systems will be supplemented by inspections on site to check that the work has been carried out satisfactorily.

THE CODE AS A MANAGEMENT TOOL

There are three areas in which the code facilitates and improves management procedures: financial management, performance management, and management information.

Financial Management

In the past the allocation of funds for routine maintenance work on all-purpose trunk roads and highways has been resource led. That is to say, a sum of money was set aside each year within the total amount available for maintenance work, which was largely based on previous outturn costs for routine maintenance. Little or no account was taken of relative performance or the number and type of specific inventory items to be maintained. There is no doubt that across the national road network standards have been uneven. The object of the code of practice is to achieve more uniform standards. This, together with inventory data, will allow the allocations of funds to be made on the basis of need. This should result in a more cost-effective use of resources.

The code identifies in precise terms how much work is to be done and what will be paid for. This ensures that realistic estimates for routine maintenance funds are received from agents.

Inventories are being prepared of the highway infrastructure on national roads in each agent's area and the inspections under the code of practice will be cross-referenced to these. The allocation of funds is to be made on the basis of the inventory and the standards prescribed in the code, taking account of any local variations.

Performance Management

One of the main purposes of introducing a code of practice is to provide some form of control over performance. As already indicated, such control has been limited, with no facility for regulation on a quantifiable basis. The code with the proposed reporting system provides this.

Management Information

The increasing awareness of the public and their greater criticism of the actions of public bodies make it essential to have effective management information systems to be able to deal with complaints. The introduction of the code itself reinforces the need for these systems because it embodies standards that will be used as a basis for judging whether duties have been properly discharged.

The department has commissioned a study to produce suitable software for handling maintenance management information. This will be compatible with the department's network information system.

REFERENCES

1. Report of the Committee on Highway Maintenance. Ministry of Transport, London, 1970.
2. Report on a Study of General Maintenance and Winter Maintenance of Trunk Roads and Motorways. Department of Transport, London, 1982.

Publication of this paper sponsored by Committee on Maintenance and Operations Management.

Review of Sign Overlay Procedures in Virginia

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ABSTRACT

The sign-refurbishing procedures used by the Virginia Department of Highways and Transportation are discussed with special attention to cost, manpower, time, and quality of the product. In addition, the results of a questionnaire survey made to obtain information on procedures used in other states are presented. Recommendations concerning the most cost-effective and expeditious method of refurbishing signs in Virginia are presented.

Traffic signs are a primary means of warning and guiding motorists, and they must be properly maintained at all times to aid the safe and efficient flow of traffic. Newly fabricated signs have good visibility and legibility; however, the reflective sheeting on the face of the signs deteriorates from exposure to weathering and the accumulation of grime. Once this deterioration reaches the point at which the sign is no longer effective, the sheeting should refurbished or replaced.

Maintaining the large number of signs on the nation's roads demands a substantial effort, espe-