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Road Maintenance Management in the Federal Republic of Germany

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ABSTRACT

An introduction is provided to a system currently being developed to manage maintenance of the road system of the Federal Republic of Germany. The purpose of the management system, which is shown to be based on cost-benefit principles, is to assist both in the decision making and actual operations associated with road maintenance. A conceptual guideline is presented that is intended to contain the most important requirements for such a management system. The guideline addresses general principles; condition survey, evaluation, and selection of maintenance measures as they affect lower, medium, and higher management levels; budget planning and resource allocation; execution of maintenance and new construction; and the creation of a road data bank. The potential savings from implementing a management system for road maintenance are estimated to be substantial and to exceed those accruing from technological advances.

A systematic approach to activities directed toward maintaining roads is a relatively recent objective in the Federal Republic of Germany. These activities, under the collective term of road maintenance, comprise all the categories of repair and rehabilitation. As a starting point, economic studies were made of road construction and agency costs as well as other overall economic evaluations including road user costs. A great deal of data already existed on these subjects. During these economic investigations, it soon became apparent that the decisions involving the type and, above all, the timing of maintenance measures were greatly affected by disparate factors, both from an overall economic and operational viewpoints.

In the meantime developments are taking place in this sphere in other countries; moreover, pressures have been growing through financial stringencies

that affect all aspects of road construction and maintenance. Both of these factors contributed to the decision by the Federal Ministry of Transport in 1979 to adopt pavement management as an important focus for road research. Since then, with the Ministry's support, considerable research activity has been directed toward this theme.

What is the primary concern in a planned management system? The relevant operational decisions required in road maintenance must be made on the basis of rational, economic principles. According to a given situation, the goal must be to achieve a desired benefit at the least cost (principle of minimizing costs); alternatively a predetermined cost may have to achieve a maximum benefit (principle of maximizing benefits). Under the economic principle of cost versus benefit some basic operational and economic questions must be considered.

- Who is responsible and how?
- What are the objectives and when will they be accomplished?
- What are the conditions under which a decision will be made?
- What will be the final result?

In connection with these questions, it will be necessary to indicate how decisions can be made in a rational way.

The objectives of a management system fall into three main decision-making categories as follows:

1. Selection of road sections requiring repair, assessment of priority, and the decisions concerning the execution of the repairs. This subject will be discussed by Schoenberger in a paper in this Record.
2. Detailed technical and economic optimization of maintenance measures; that is, select the economically optimal combinations of materials and pavement type, design and strengthening strategies, maintenance strategies, and relevant construction aspects. The most favorable time for executing the work, the optimum site size, and the planned traffic management during the period of repair are also part of this decision.

3. Short-, medium-, and long-term forecasts of the budgetary needs for road maintenance. Categories 2 and 3 will be discussed by Schmuck in a paper in this Record.

A comprehensive guideline (1) is planned to assist in achieving these objectives. It will contain the most important requirements for a rational road maintenance system. The concept for this guideline is shown in Figure 1. In addition to an introduction to the problems of a rational decision-making practice, the guideline will contain six parts that can be used separately (Parts B through G).

Part B will deal with general and theoretical principles for systems application and will contain information on the optimization process for decision making (i.e., comparisons between various alternatives). Parts C and D are to be practice related, that is, provide operational guidelines for condition survey, assessment, and decision making concerning particular repair measures. Part C will be directed toward the lower echelons of management, and Part D will be directed toward middle or top management, that is, the highway departments and ministries. Part D will also contain advice concerning points in time for intervention and preparing

A INTRODUCTION	<ol style="list-style-type: none"> 1. Framework of problem, objectives and discussion of aims 2. Advice on use of the Guideline
B GENERAL PRINCIPLES	<ol style="list-style-type: none"> 1. Methodological Principles <ol style="list-style-type: none"> 1.0 Basic concepts 1.1 Elements of the planning process 1.2 Basic structure (Flow sheet) of the planning process in general 2. Planning concept (Management systems) "Road" <ol style="list-style-type: none"> 2.0 Structure of management system 2.1 Planning case: "Construction of new roads" 2.2 Planning case: "Road maintenance" 3. Operational factors relating to objectives and evaluation <ol style="list-style-type: none"> 3.0 Planning objective "Pavement" and factors affecting it 3.1 General system-related objectives and criteria 3.2 Specific objective-related aspects and condition factors 3.3 System objective "Pavement" and weighting aspects 4. Principles of the comparison between alternatives (variants) <ol style="list-style-type: none"> 4.0 General 4.1 Energy savings aspects 4.2 Operational factors 4.3 Overall economic factors
C CONDITION SURVEY, EVALUATION AND SELECTION OF MAINTENANCE MEASURES AFFECTING THE LOWER LEVELS OF MANAGEMENT	<ol style="list-style-type: none"> 1. Basic principles 2. Continuous observation of condition, routine inspection <ol style="list-style-type: none"> 2.0 General 2.1 Practical observation of condition 2.2 Order of priorities 3. Periodic condition survey, condition assessment <ol style="list-style-type: none"> 3.0 General 3.1 Condition survey according to individual characteristics 3.2 Overall evaluation and order of priorities 3.3 Determining the wider operational competence 4. Establishing the appropriate maintenance measures (without economic assessment) <ol style="list-style-type: none"> 4.0 General 4.1 Operational aspects 4.2 Operational and constructional aspects 4.3 Maintenance measures in connection with operational aspects
D CONDITION SURVEY AND EVALUATION, DEVELOPMENT AND SELECTION OF ALTERNATIVE MEASURES AFFECTING MIDDLE AND HIGHER LEVELS OF MANAGEMENT	<ol style="list-style-type: none"> 1. Principles, Design aspects 2. Additional condition survey, condition evaluation 3. More extensive condition survey, condition evaluation 4. Forecasting: predicting times of intervention (with order of priorities) 5. Development of possible alternative measures <ol style="list-style-type: none"> 5.0 General 5.1 New Construction (Design, selection of type of pavement, thickness design) 5.2 Maintenance measures (Rehabilitation, Reconstruction) 6. Forecasting and evaluation of expected condition changes, comparison and arrangement of variants <ol style="list-style-type: none"> 6.0 General 6.1 Comparative calculations regarding energy savings 6.2 Comparative calculations regarding operational savings 6.3 Comparative calculations regarding overall economics
E BUDGET PLANNING AND SCHEDULING OF RESOURCES	
F EXECUTION OF NEW CONSTRUCTION AND MAINTENANCE	<ol style="list-style-type: none"> 1. Principles 2. Carriageways <ol style="list-style-type: none"> 2.0 General 2.1 Base courses 2.2 Bituminous pavements 2.3 Concrete pavements 3. Other areas <ol style="list-style-type: none"> 3.0 General 3.1 Bridgedeck surfacings 3.2 Cycle and footpaths 3.3 Parking area surfacings 4. Documentation
G DATA COLLECTION	<ol style="list-style-type: none"> 1. Principles 2. Road data bank (lower level) 3. Road data bank (central level)

FIGURE 1 Draft structure of the "Guideline to Pavement Management."

orders of priority. Of particular interest in Part D, for rational decision making, will be those sections that deal with processes leading to the development of alternatives of maintenance measures and a comparison between these alternatives.

Part E will deal with the basis for budgetary planning and resource allocation regarding a major current problem, that is, obtaining short-, medium-, and long-term financing for the necessary road maintenance. Part F will contain a collection of relevant regulations for the execution of construction and maintenance measures, as well as advice on documentation required for completed works. Finally, Part G will contain recommendations for data collection.

The introduction and development of such a management system will make it possible to achieve more rational decisions in the field of road maintenance than has been possible in the past. It is expected that the planned guideline will become an important source of information for experts involved in decision making.

Parts of the guideline will be similar to, or may even contain, accepted standards. The application of these parts will not involve extra expenditure. Other parts, however, especially those devoted to the processes of selection, are likely to introduce new techniques requiring a certain amount of training and training ability. So as not to risk the general acceptance of the system, it appeared advisable to adopt a stepwise approach toward its development and introduction. Initially this will be based on small local administrative centers.

The considerable costs involved in making such a

system effective will be justified if it succeeds in ensuring that the road maintenance is based on cost benefit principles. The possible savings are considerable and are certainly more than the 5 to 10 percent forecast from new methods involving technological advances in bituminous and concrete pavement construction (2).

It will be necessary, under any circumstance, to ensure that the management system created can be applied and checked in an adequately simple fashion. At the same time, however, the system must be based on well-founded principles so that the decision maker can achieve not just apparent, but real optimization of decisions and actual operations in the sphere of road maintenance.

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A Pavement Management Information System for Evaluating Pavements and Setting Priorities for Maintenance

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ABSTRACT

An essential task of those active in road technology is ascertaining the quality of road installations built in the last decades, and thereby ensuring objectively that the existing installations actively satisfy the requirements as described for the road in question. The German Road and Transportation Research Association has developed a national system to assess the road condition. A condition survey is conducted by both visual and technical means to arrive at a condition index. The decision of when to execute certain maintenance measures is based on a minimum acceptable value for the condition index.

The increasing number of projects and the high volume of public expenditure, coupled with constant concern over the financial investment in the road infrastructure, have made it essential to take steps to maintain the existing road stock, just as it would be necessary to maintain any other major economic asset that is subject to constant deterioration. This will ensure that the road system fulfills the expectations set by its design. It is desirable, therefore, to develop objective problem evaluation techniques, not hitherto attempted, within the framework of a pavement management system (shown in Figure 1).

The basis of every management system is an objective analysis of the problem area. For the management system discussed in this paper the pavement condition must be defined, observed, and evaluated