Simple Technical Model for the Maintenance of Low-Volume Roads in Austria

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A new model for the systematic maintenance of rural roads in Austria is described which has been elaborated in the course of a research work for the Austrian Ministry of Agriculture and Forestry. The main part of the work deals with the development of a technical maintenance system consisting of the following individual steps: (a) Inventory and documentation of the existing roads and their conditions (data base) as a basis for the exact characterization and assessment of the individual roads and the assignment of further data. (b) General data collection that primarily aims at the recording of the condition of the network. In this, the main target is not the exact recording of the conditions of the roads with view to individual damage features, but the distinction between roads or sections in good conditions and those for which a further, detailed investigation is demanded. (c) Detailed investigation of the sections for which rehabilitation or reconstruction measures are necessary. The detailed investigation aims at the development of the maintenance project, including the selection of the technically appropriate and the economically most efficient variant of the rehabilitation or reconstruction measures which might be applied. (d) Priority rating of individual measures within the considered network. The indicators that are necessary for the rating are the condition of the road, number of users, traffic category, traffic load, and the length of the section that needs rehabilitation or reconstruction.

The rural road network consists of all roads that are neither federal nor provincial roads and that serve the purpose of rendering possible an areal access to the rural area. This low-volume road network consists of all municipal roads, farm roads, and forest roads. Its total length in Austria amounts to about 150 000 km.

As the responsibility for construction and maintenance with view to this road network is split up between private persons and public authorities there is no exact documentation as to its length and condition. In practice up to now, maintenance measures were only carried out randomly.

On behalf of the Austrian Ministry of Agriculture and Forestry, therefore, a proposal for a maintenance system for rural roads has been developed at the Institut for Transportation Engineering of the Vienna University of Bodenkultur (*1*). The system was elaborated in steady contact with the representatives of the appropriate province authorities, which ensures that practical requirements have been incorporated as well.

Thus, a system can be offered that is simple and easy to handle but is in itself methodologically and technically consistent. It is based on already existing solutions for the primary as well as for the secondary road networks (*2–12*) and takes into consideration the possibilities and needs of the agencies in charge of the construction or the maintenance of rural roads in Austria.

The testing of the system in practice has been finished. At this time, the system is adapted to be installed in a personal computer so that the processing of the data can be handled easily.

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GENERAL FOUNDATIONS

Definitions

In order to differentiate between the various activities in the maintenance of roads, the following terms and concepts are used in Austria.

Operational Maintenance

Operational maintenance includes winter maintenance (clearing and spreading) the clearing of the carriageway and parking places of contaminations, the maintaining of the planting (cutting of plant growth and maintenance of the necessary clearance) and eventually also the examination and restoration of road signs and road markings. Measures of this kind can hardly or only to a small degree be planned in advance. They are either carried out on the basis of a condition recording according to needs arising or in regular fixed intervals.

Constructional Maintenance

Constructional maintenance includes all measures that serve the maintenance of the road and the roadside ancillaries.

Constructional maintenance can be divided into three kinds of maintenance activities. Figure 1 shows these three kinds of maintenance activities within constructional maintenance.

Routine Maintenance Routine maintenance includes all measures that are unavoidably and immediately necessary to preserve the structural quality of a pavement and its level of service. Generally, these are measures that are carried out continuously and instantly, like, for example, small repairs.

Constructional Maintenance		
Routine Maintenance	Rehabilitation, Restoration	Reconstruction, reconstructional alterations

FIGURE 1 Activities in constructional maintenance.

They must be carried out as soon as possible after the deficiencies have been recognized to repair the damage and to avoid the development of secondary damage. Long-lasting effects, however, cannot be expected as a consequence of routine maintenance measures. Measures of this kind are neither included in a long-range maintenance program nor in a rating of priorities, but are carried out periodically according to needs arising and as soon as possible.

Rehabilitation Rehabilitation activities include all extensive measures that are applied to preserve the Level of Service or to improve the structural qualities. In practice, these measures are applied to surface layers and wearing courses in longer road sections and at least to the full width of traffic lanes, such as, for example, the placing of a wearing course. Rehabilitation measures may already effect an improvement of the serviceability of the road, especially in cases for which the placing of additional bases or wearing courses on the existing pavement results in an additional strengthening effect. Rehabilitation measures will be applied at periodical intervals even if the necessary measures of a routine maintenance are regularly carried out. Regular and proper routine maintenance activities will, however, considerably extend the interval between rehabilitation measures.

Reconstruction and Reconstructional Alteration Reconstruction measures include so far-reaching measures that the final result is equivalent to a new pavement, which means that no rehabilitation measures caused by structural damage are necessary within the usual life cycle.

A reconstructional alteration is a reconstruction with simultaneous alterations of alignment elements or the width of the cross section of the road. Reconstruction also includes the reconstruction of drainage channels and other drainage facilities. The boundaries between these three kinds of maintenance activities are fluid.

From the practical point of view, however, an exact differentiation does not seem necessary, so that this basic framework may primarily serve for a rough assignment of individual maintenance activities to one of the three kinds mentioned.

Special Circumstances in the Maintenance of the Rural Road Network

An essential difference to the maintenance of federal and provincial roads is the fact that in rural roads the persons or institutions who are responsible for the maintenance are almost always different from those who carry out the maintenance works. With the exceptions of municipalities who run their own maintenance depot or special cases of maintenance cooperatives, orders for maintenance works are either placed with firms or they are carried out by the departments responsible for the construction of rural roads themselves either for the municipalities or for the group of persons whose interest is the maintenance of the road.

Even though in most of the cases the second of the mentioned possibilities works well in practice, there is actually never a basis for an obligatory cooperation between the institution or department providing the maintenance funds (financier) and the technical agencies (the technical advisers or the staff carrying out the maintenance works).

The institutionalization of such a cooperation as a basic precondition for a systematic maintenance of rural roads might above all be achieved through the provision of appropriate financial funds [cf. *Fund for the Maintenance of Rural Roads of the Province of Salzburg* (*13*)].

Contrary to that, the application of methodological maintenance systems is much easier in the federal and provincial road network. In these, road construction departments or road maintenance depots are responsible for the maintenance of the road network within their competence on behalf of the authority providing the maintenance funds (federal or provincial government). Within the bounds of the allocated funds, they are directly responsible for decisions concerning the time and priority of maintenance measures as well as for the realization of the maintenance works (whether they carry them out themselves or entrust a firm). The whole management of the maintenance is thus undivided.

The previous considerations are only relevant as a background for the application of the system and not for the system itself. A basic consideration for the development of the model was that it should be applicable to all cases that might occur in connection with the maintenance of rural roads. It is intended to be applicable for individual municipalities as well as for a whole province. It has to be noted, however, that the application of objective decision models is the more useful the larger the network is on which they are based as the advantages of an objective assessment and listing of measures according to priorities can only then be fully effective.

To take account of the given situation, the proposed system has to imply the possibility of a flexible application to achieve general acceptance. That means that it has to be considered that

- The possible users (municipalities, construction departments, and provinces) have up to now dealt with problems of systematic maintenance in a quite different way and degree; and
- The roads making up a network may often reveal quite essential differences as to their state. This condition applies especially to cases for which the model shall also be used for

the maintenance of roads that were not built according to the respective state-of-the-art.

As in other cases in which a new system is installed, the introduction of the described maintenance model in the initial state will naturally lead to organizational difficulties as well as to problems in the acquisition of the necessary basic data, the general inventory of the network, and the like. Of course, it will be necessary to schedule a longer period for these time-taking preliminary and initial works.

As soon as the basic inventory and the preliminary works have been made for the whole network, the acquisition of the data will require much less expense. These routine works mainly imply the updating of information already documented or the extension of the information basis for decisions taking into account economic criteria (e.g., current price increases).

Strategy on Which the Maintenance Is Based

Basically, there are two extreme strategies for the maintenance of the road network. The first strategy does without measures of routine maintenance and regular rehabilitation. When the condition of the road falls below a level that is acceptable, the road will be reconstructed.

An alternative to that is the strategy that applies measures for the best possible routine maintenance connected with periodic rehabilitation measures.

Figure 2 shows a schematic representation of the two different strategies and the development of performance curves (development of deterioration) resulting from their applications.

It can clearly be seen that Strategy 2 results in a substantially higher serviceability over the whole time span and thus in relatively low decreases of the pavement condition and traffic safety.

If Strategy 1 is applied, however, the condition of the pavement remains for a long time below its initial condition. On the basis of technical and economical considerations, it can be concluded that the strategy that includes routine maintenance is the better one. Routine maintenance in time reduces the danger of the development of secondary damage and thus prevents the progressive development of damage. Furthermore, it is normally easier to invest smaller sums continuously, whereas the funds for a reconstruction at the proper time are often not available.

The presented maintenance model is based on the assumption that the strategy involving routine maintenance measures is applied. Routine maintenance measures are therefore not an issue for detailed considerations and priority ratings but are normally carried out periodically. But this is only true for cases in which sufficient financial means for routine maintenance works are provided. If these means are not available, a deterioration of the average level of the network must be expected.

MODEL FOR TECHNICAL DECISIONS

General Remarks

The proposed model for technical decisions on the maintenance of rural roads will be discussed in detail in the following. In accordance with the considerations and targets presented previously, it must be applicable to rural road networks consisting of any possible pavements. This is important, especially in cases where the decision-taking institution has practically no information on the existing network. So, the model is divided into the individual steps of

- Inventory, determination of the boundaries of the network;
- General recording of the condition in order to quickly get a survey over the kinds of pavements and the conditions of the pavements of the individual roads;
- Detailed assessment of the sections for which maintenance or rehabilitation measures are necessary, with additional investigations;
- Decisions on measures to be applied in the respective section (maintenance project). As the solution resulting from this procedure refers to a certain project, this step is called decision on project level.

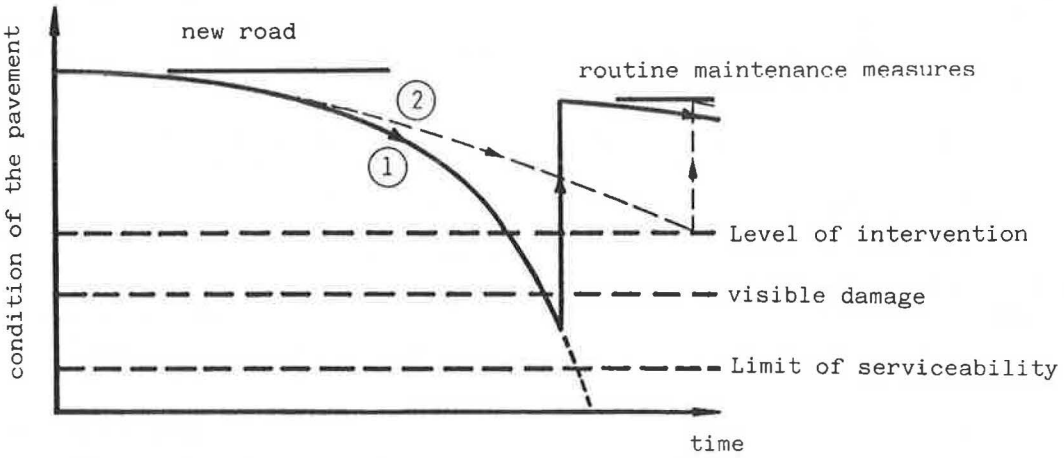

FIGURE 2 Performance curves in different strategies.

If sufficient information on the structure of the network is already available, this step of the inventory may be omitted. Also, the general recording of the condition can be dispensed with if there are relevant actualized recordings. In this case, it is possible in the presented model to start with the step of detailed investigations. In routine application—after the ending of the initial state—this will be the normal case.

The result of the technical considerations, the definite proposal for a measure to be taken in a certain section must then be subjected to an assessment of its urgency on the level of the whole network.

All these detailed considerations refer to rehabilitation or reconstruction measures. As for routine maintenance measures, it is assumed that they will be carried out periodically or shortly after it has been recognized that they are necessary.

Individual Steps of the Decision Model

Inventory

The precondition for all considerations concerning the systematic planning of maintenance measures is the recording of the road network to be included in the planning procedure and the knowledge of the condition of the individual roads or road sections.

If there are no recordings of the existing road network in the initial state, first of all a recording of all the roads of the network has to be carried out in which the names; road numbers (code numbers); positions; constructional data (length, width, year of construction); significance within the network; traffic loads; and the like of the individual roads are registered. This information forms the basis for all following considerations concerning the individual roads.

At the same time, the respective roads are divided into sections for which the characteristics remain the same. Thus, for example, a larger branched road must be subdivided at least into main road and access roads. In practice, the inventory of the network is in most cases carried out simultaneously with the general recording of the conditions of the individual roads. It is helpful to document all road data, traffic data, and the like and all successively collected condition data in a data base.

Assessment of the Condition

If it is again assumed that there is no information on the condition of individual roads in the initial state, having a survey as quickly as possible is necessary first of all.

For the recording and evaluation of the conditions of roads, it is therefore proposed to follow the procedure shown in Figure 3.

General Assessment The primary target in the first step of the recording of the state is first of all the recording of the condition of the network. This step of the recording does not aim at an exact registration of the condition of the pavement with view to individual damage characteristics. It shall rather render possible a differentiation between roads or sections in

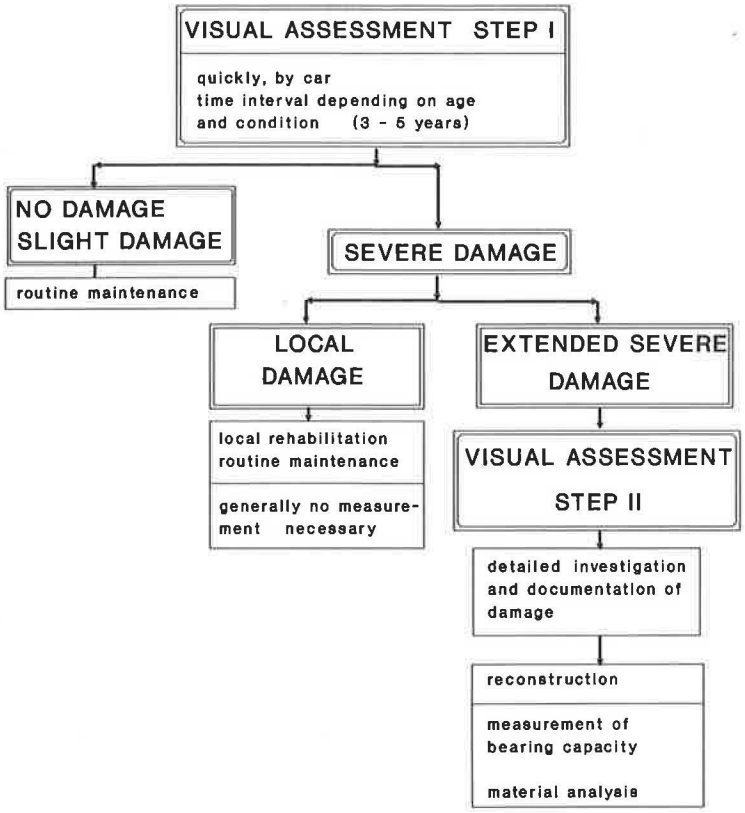

FIGURE 3 Visual assessment.

good condition and others that require further detailed investigations.

It is useful to collect the general data by driving along the roads by car. Only in this way is it possible to master the recording of the network that may be extensive within an acceptable time. The results of the data collection are taken down in a form that has been drawn up for this step. The given situation (with view to the demand of time and personnel as well as the required assessments) has been taken into account in the extent of the data to be recorded. The positioning and determination of the length of the sections is made by means of the hectometer counter within the car.

In the course of the data recording, it may prove necessary to further differentiate the division that has been made in the recording of the network into sections, if the kind of pavement or its condition changes. Only these subsections that are homogeneous in their essential characteristics are the basis for all further considerations.

For the practical realization of this recording from within a car, it seems necessary to use a team consisting of at least two experts for maintenance issues. If the recording is carried out by a larger staff (several teams), the mutual coordination of the recording procedures of the individual teams has to be considered.

As far as possible, general recordings of the condition should be made during the spring period as damage occurs to a higher degree during this season and additionally appears clearly then.

The general recording of the condition must subsequently be repeated at regular intervals to actualize the recorded data. Dependent on the conditions and life cycles of the individual roads, the interval for this systematic actualization is determined. Contrary to older roads in worse condition, a larger interval can, for example, be chosen for roads in good conditions or for lately reconstructed roads.

A maximum interval of 3 to 5 years seems appropriate to be able to register deteriorations in time and also to assign the occurring deteriorations to a certain interval of time. Only this forms the basis for the forecast of the future condition or the development of the deterioration.

If heavy local damage occurs in between the intervals that demand immediate repair, the necessary measures must be taken as soon as the damage has been realized or reported.

In routine application (when the basic recordings have been finished and the system has been installed), the periodically carried out recording of the condition may eventually be substituted by respective reports on the measures taken in routine maintenance works.

For the documentation of the recording, a form has been developed that may be used for the step of the general recording for different pavements that may occur [unbound pavements, asphalt pavements, cement-stabilized bases, and concrete pavements (see Figure 4)].

Besides the name of the road, the road number (code number), municipality, and district, also the length, the width (cross section), and the year of the construction of the road or road section are registered. Additional data give information on the quantity of traffic and the function of the road within the road network.

To determine individual subsections, if necessary, a line is given to mark their position.

The recording of the pavement condition of the road is then carried out with a differentiation according to relevant individual damage characteristics. This differentiated recording is the basis for a distinction between different deterioration states or subsections of a road.

Assessment Mark I means that routine maintenance is sufficient.

Assessment Mark II means that routine maintenance and local repairs are required.

Assessment Mark III results in a detailed investigation.

It saves time to record the condition of the pavement while driving in one direction and to record the conditions of the roadside ancillaries and other buildings on the way back.

In order to have a better survey, it is advantageous to put down the results of the assessment also in the head line of the form. If there are subsections, there may be two or three assessment results.

On the basis of this investigation, subsections with an Assessment Mark III are sorted out. These subsections demand additional detailed investigations in a further step.

From the data on the condition and the respective assessment, the interval to the next general data collection can be estimated.

Detailed Investigation

Only those roads that show extensive and heavy damage—in other words those that got the evaluation Mark III in the general assessment and were sorted out—are subjected to a detailed investigation in the second step. In these roads, expensive rehabilitation and reconstruction measures are necessary.

Thus, the aim of the detailed investigation is on the one hand the elaboration of the maintenance project including the determination of technically appropriate variants from several alternative measures and on the other hand the providing of the information needed to evaluate the priority and urgency of these measures compared to other maintenance projects on network level. The detailed investigation is carried out by an expert on maintenance activities on foot. The necessary equipment consists of a measuring wheel for the exact registration of individual deficiencies together with a rule and a rod to determine the depth of transverse deformations or of settlements.

It is again important that the methodology is objectified before the beginning of the assessment and in regular intervals while the assessment is being carried out. The best way to do so is a joint investigation of selected road sections by several assessment teams followed by a discussion and adaptation of the respectively recorded results. In order to guarantee a uniform treatment of occurring damage, a special catalogue listing deficiencies that may occur has been elaborated.

The detailed investigation is practically carried out by means of a form that is especially adjusted to the needs of a determination of appropriate measures and an evaluation of the priority and urgency of measures. For each kind of pavement (unbound pavements or asphalt pavements, cement-stabilized bases, or concrete pavements), a separate form has been developed.

Figure 5 shows the form to be used for bituminous pavements as an example.

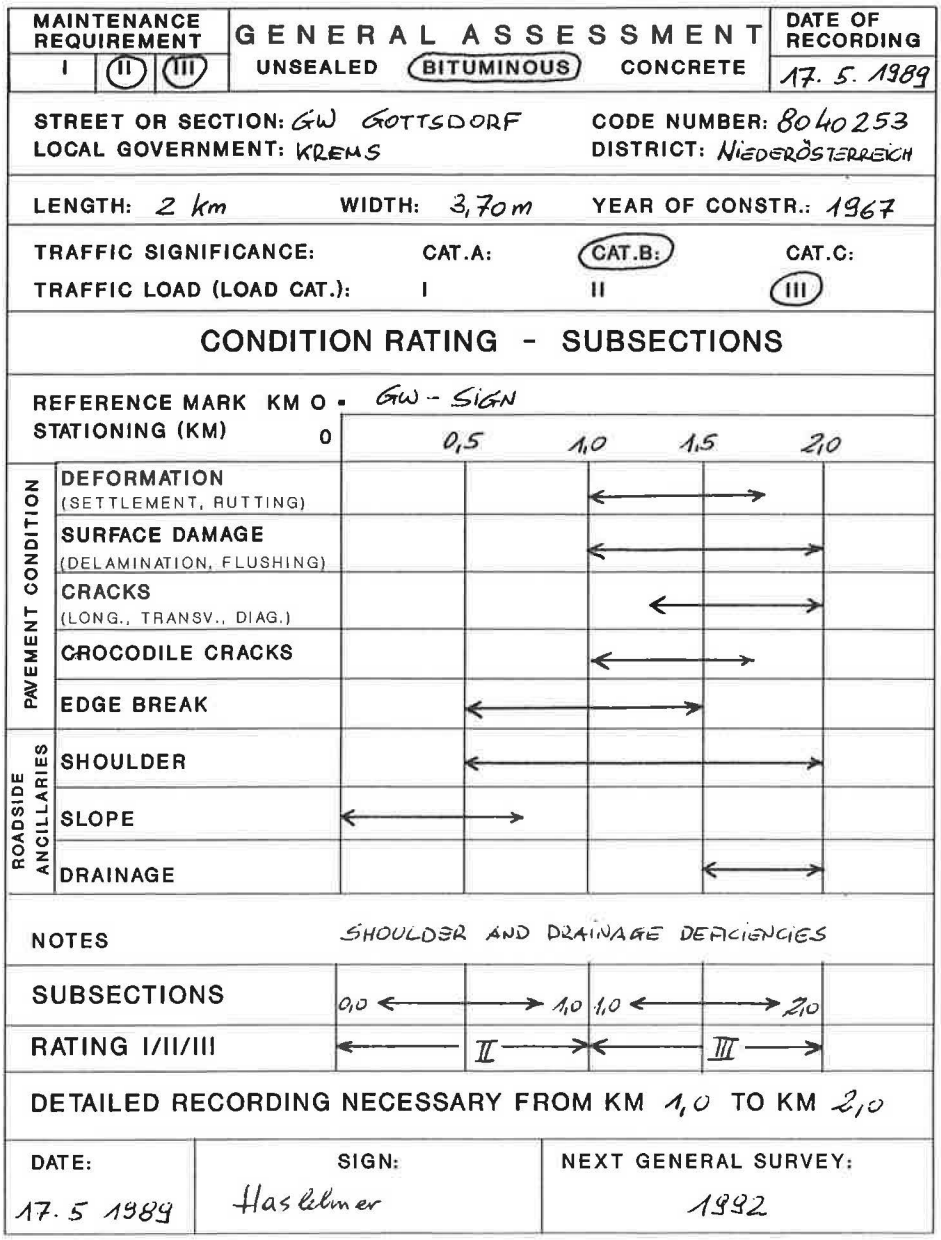

FIGURE 4 General assessment form.

General information may directly be taken over from the form recording the general condition. In addition, the number of regular users is recorded for these sections as well as particular heavy traffic that may occur (e.g., transportation of wood or tank trucks transporting milk).

The visual assessment of the pavement condition is made by recording the individual relevant damage characteristics as they are listed in the damage catalogue.

In addition, damage at drainage facilities and roadside ancillaries is documented.

The last two columns (proportion in length and extent) already deliver indicators for the successive priority rating. As to information on drainage facilities, the two values mentioned are not recorded separately, as it can be expected that deficiencies in these facilities will have a direct effect on the condition of the pavement and thus need not separately be considered in the priority rating.

Further, results of analyses of the construction material and of bearing capacity measurements are also put down in the form. At that time, bearing capacity measurements are normally carried out with the Benkelman beam under a wheel of 50 kN. The results are used on the one hand to divide the investigated section into homogenous subsections, and on the other hand for the dimensioning of the strengthening of the pavement, using, for instance, the diagram of the Asphalt Institute (*14*).

Since 1990, also two falling-weight deflectometers have been in use in Austria. Their application will in future render possible a back-calculation of E-moduli of the pavement layers and thus an analytical dimensioning of the pavement.

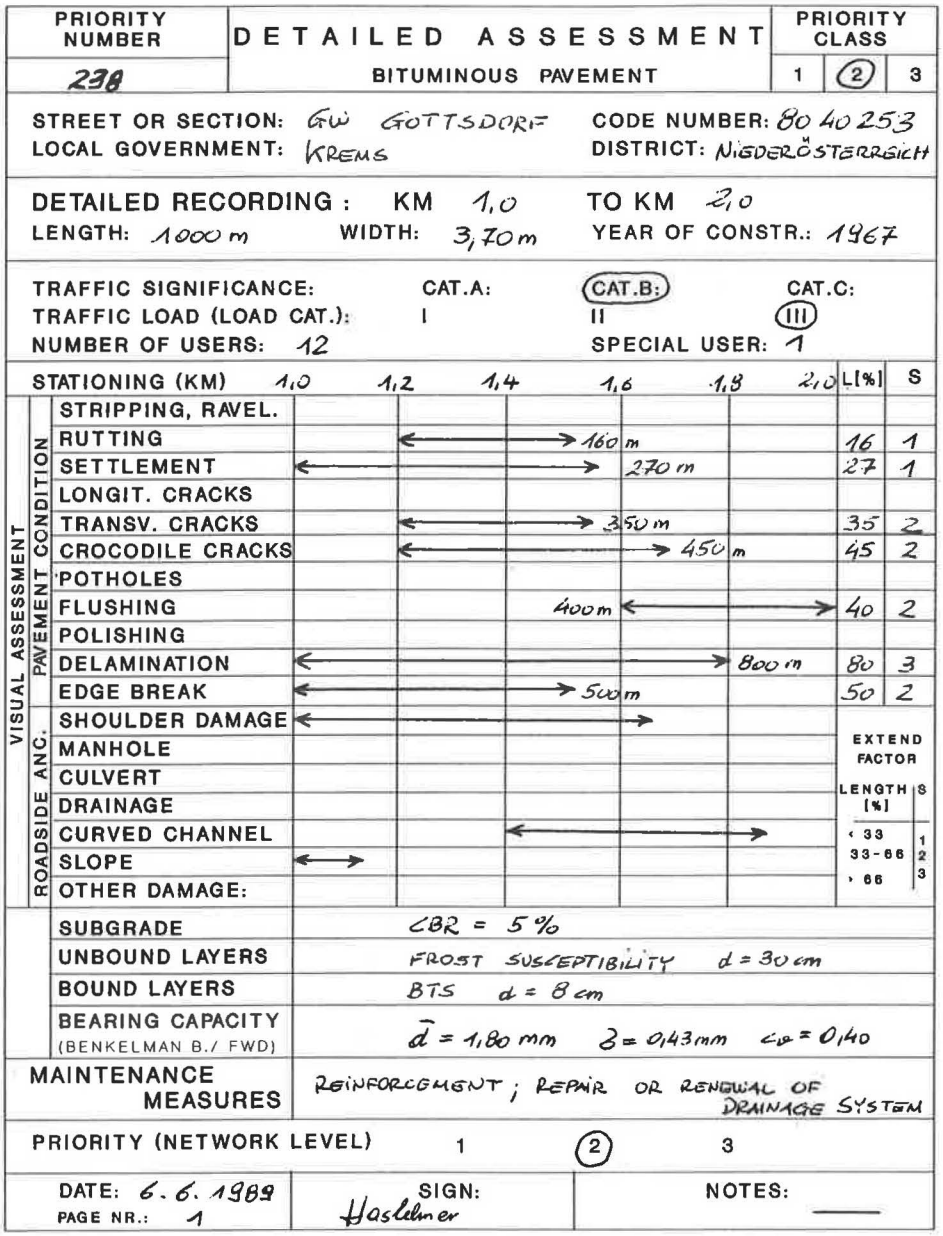

FIGURE 5 Detailed assessment form.

On the foundation of this technical basic information, the maintenance project is developed. In the course of its elaboration, several variants may be considered with respect to the given situation. The selection of a solution out of technically equivalent possibilities is based on a rating of their economic efficiencies.

The proposed measures resulting from this investigation are taken down in a form and eventually explained in a supplementary sheet.

Later on—as a result of the priority rating carried out successively—the priorities for these measures may be recorded in the head of the form.

Thus, the form for the detailed investigation provides a documentation of the condition of the section concerned, the proposed measures, as well as the urgency for the execution of these measures with a view to the whole basic network.

PRIORITY RATING

General Remarks

After a decision has been taken at project level on which of the measures for rehabilitation or reconstruction is the economically most efficient, it is necessary to rate these individual measures as to their urgency of execution with view to the whole relevant network (a decision at network level).

For this purpose, a procedure is proposed for the priority rating of rehabilitation and reconstruction measures that is especially adjusted to the conditions applying to the rural road network. This method is applicable to a network of any size, though it ought to be stressed that the appropriateness of such a priority rating increases the larger the network. A precondition for its application is a clearly defined network. This may, for example, be the whole road network that a municipality has to maintain. From the point of view of an administration providing the maintenance funds, the network might also be defined as the total of all roads for which funds have to be provided.

In the procedure for the rating to be described, only those parameters are taken into account that are either known from a detailed investigation or can be easily obtained by additional data collections.

The priority rating is made with the help of a form (shown in Figure 6). The results of the detailed investigation (damage assessment) may directly be transferred into this form. Together with the additional parameters (number of users, traffic significance and traffic load, and length of the section), it provides the basis for a simple and quick determination of the priority number.

It is further possible to assign a certain road in correspondence with its priority number to a priority class that is valid for the considered road network. In practical application, this may be advantageous as it makes the consideration of additional local criteria easier in the process of decision finding.

PRIORITY NUMBER 238 — **PRIORITY ASSESSMENT** — **PRIORITY CLASS** 1 (2) 3

STREET OR SECTION: GW GÖTTSDORF — CODE NUMBER: 80 40 253
LOCAL GOVERNMENT: KREMS — DISTRICT: NIEDERÖSTERREICH

DETAILED RECORDING: KM 1,0 TO KM 2,0

DAMAGE	EXTEND FACTOR S	IMPACT ON THE USER: IMPACT FACTOR B1	S•B1	P1 = S•B1••B2•B3	LOSS OF VALUE: IMPACT FACTOR W1	S•W1	P2 = S• W1•W2
STRIPPING, RAVEL.		1			2		
RUTTING	1	2	2		2	2	
SETTLEMENT	1	3	3		3	3	
LONGIT. CRACKS		1			2		
TRANSV. CRACKS	2	1	2	USER B2	2	4	TRAFFIC LOAD W2
CROCODILE CRACKS	2	1	2		3	6	
POTHOLES		3			3		
FLUSHING	2	1	2	2	1	2	
POLISHING		1			2		
DELAMINATION	3	2	6	•	2	6	1
EDGE BREAK	2	3	6	TRAFFIC SIGNIF. B3	2	4	
SHOULDER DAMAGE		1			3		•
FAULTING		3			2		
SPALLING		2			3		
SCALING		1		2	2		
SKID RESISTANCE		1			2		
CHANNEL		2		•	3		
		Σ S•B1	23		Σ S•W1	27	
		P1•(ΣS•B1)•B2•B3		92	P2•(ΣS•W1)•W2		27

LENGTH OF SECTION • LENGTH FACTOR L • 2

→ PRIORITY NUMBER P = L•(P1+ P2)• 2 •(92 + 27)• = 238

→ PRIORITY CLASS 2

FACTOR USER		FACT. TRAFFIC SIGNIFICANCE		FACT. TRAFFIC LOAD		FACT. LENGTH	
USER	B2	CAT.	B3	LOAD CAT.	W2	LENGTH	L
1-5	1	CAT.C	1	III	1	< 500m	1
6-20	2	CAT.B	2	II	2	500-2000m	2
> 20	3	CAT.A	3	I	3	> 2000m	3

DATE 10. 08. 1989 — DETAILED SURVEY FROM: 6. 6. 1990; Haslehner — NOTES: ———

FIGURE 6 Priority assessment form.

Therefore, a kind of uniforming effect that may occur is deliberately accepted.

The relevant parameters are discussed in detail in the following.

Parameters for the Priority Rating

Condition of the Road

First, the given condition of the road is characterized as to the kind and extent of damage occurring. Then it is evaluated with a view to the decrease of pavement condition, on the one hand, and with a view to secondary damage that is to be expected if maintenance measures are deferred, on the other hand.

Extent of Damage In the detailed investigation, every type of deficiency has been recorded in the form with the extent of its occurrence. From the length over which a certain type of damage occurs, the proportion of this damage may be calculated in percentage of the section length (last but one column in the form for detailed investigations, see Figure 5).

This proportion of length is classified and an extension factor S ranging over lengths 1 to 3 is accordingly deduced (see form, Figure 5). The extension factor is directly taken over in the form for the rating of priorities.

Impact on the User When the condition of the road is evaluated from the point of view of the road user, the decrease of the driving comfort as well as the involved safety risk is considered. According to the impacts on one of these aspects, the individual deficiencies are assigned an impact Factor B1 in which Factor 1 signifies the smallest impairment (and Factor 3 would signify the greatest). These extension factors are given in the form.

Damage at guardrails and balustrades are not taken into account as it may be assumed that this damage will be remedied as soon as possible and not only when rehabilitation measures are carried out.

Loss of Valuc (Damage Development) It is tried to evaluate indirectly to what extent the value of the pavement will decrease if the necessary rehabilitation or reconstruction measures are not realized. This evaluation is made on the damage development that is to be expected. Accordingly, the individual deficiencies are assigned an impact factor W1 signifying the different aggressivity of the individual damage types. Factor 1 signifies the least increase in damage and Factor 3 the largest one that is to be expected. This impact factor is also given in the form (Figure 6).

Number of Users

It is assumed that a measure will be the more urgent the more regular users are impaired by the bad condition of the road.

The dependence on the number of users is determined by the Factor B2 (see Figure 6).

Traffic Significance of the Roads Within the Network

It is assumed that roads of greater regional importance should have a higher Level of Service and that therefore rehabilitation or reconstruction measures should be carried out on these at an earlier time.

According to the valid standard on rural roads and ways (*15*), a division is made into three categories and each category is assigned a factor B3.

- Rural road of low traffic significance
  - —Farm roads and forest roads, B3 = 1;
  - —Access to permanent habitations, B3 = 2.
- Rural roads of greater traffic significance, B3 = 3.

Traffic Volume

It is assumed that individual damage occurrences become more severe only at a later time if the traffic volume is low, whereas a high traffic volume may eventually cause a higher degree of severity of the damage after a relatively short time. If there is a higher traffic volume also, the risk of the occurrence of secondary damage is higher.

Accordingly, roads that carry a higher traffic volume must be rehabilitated earlier.

To evaluate the traffic load, a division into load categories is made and a factor W2 is assigned to each of the load classes.

The classification of roads according to load categories is known from the elaboration of the maintenance project.

Load Category	*Equivalent Single-Axle Loads (100 kN)*	*Factor W2*
I	$\leq 5 \times 10^4$ (10 trucks/day)	3
II	$\leq 1 \times 10^4$ (2 trucks/day)	2
III	$\leq 2 \times 10^3$ (2 trucks/week)	1

Length of the Section

In the consideration of the length, the subsection which needs rehabilitation and for which a maintenance project has accordingly been developed, forms the basis. Thus, the length may be the total length of the road but it may also be only a section of it.

It is assumed that the impairment of the user but also the extent of a possible loss of value increases the longer the deficient section is. Therefore, the length factor L has an impact on both of the mentioned criteria. In the determination of the length factor, it has been roughly differentiated into three length classes (see Figure 6).

Section lengths of more than 2 km do not effect a further increase of the urgency of rehabilitation.

STATE OF IMPLEMENTATION OF THE MAINTENANCE SYSTEM

The proposed system for the maintenance of low-volume roads has been tested in practice. About 400 km of the rural road network was examined according to the described method in various Austrian provinces. For the general assessment, about

15 km per day may be recorded. For the detailed investigation, a recording performance of 3 to 5 km per day is possible.

The results are in good correspondence with the practical experience of road construction engineers. The method is merely a systematic instrument, and the decision on which maintenance measure shall be applied must still be taken by the engineer.

At present, a general assessment according to the presented concept is being started in several municipalities and provinces.

In some of the Austrian agencies responsible for the maintenance of roads, recordings of maintenance activities are made by means of index cards. Because of the extent of the rural network, this kind of documentation seems to fail to be appropriate. Furthermore, there is the disadvantage that it causes great difficulties in carrying out evaluations concerning the whole network.

For this reason, an easily handled program for a PC is developed. With this program, it will be possible to make an inventory, to document the condition, to make priority ratings, and to assess the necessary maintenance budget.

Thus, it will be possible to process the collected data quickly and to actualize them at any time desired.

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