determine the necessary maintenance. The adopted optimal solution takes into consideration the financial and technical aspects as well as disruptions in traffic.

The Netherlands selects maintenance and rehabilitation activities for the near future. The choice of the adequate intervention measure is based on the cost to assure a given service level. A research project for an optimization concept has been started. It considers two questions: the first examines the minimum yearly maintenance budget when the set of quality standards is prescribed; the second is how to adjust quality standards to a given yearly maintenance budget.

Finally in my own country, Belgium, a road network assessment and monitoring methodology is being developed. It is based on a comparison of assessment parameters with the visual inspection of the road, which is carried out every 5 years.

Implementing Use of Microcomputers in the Highway Maintenance Program of New York State

GEORGE R. RUSSELL

I appreciate this opportunity to report briefly on some success with a management technique for introducing microcomputers to an organization and developing their use within the organization.

The New York State Department of Transportation (NYSDOT) Highway Maintenance Program is organized into 68 residency organizations that are county size. They are the lowest highway maintenance organizational element that has administrative and clerical responsibilities. Although they are the lowest organizational elements, they still have a significant amount of such work. For example, a residency clerical staff of two is expected to provide all payroll, personnel, and purchase support for a work force of approximately 80 people and a budget of approximately $1.5 million.

NYSDOT has had reasonably contemporary computer support at the main office level for 25 years, however, no significant computer support has been extended down to the residencies. In the late 1970s, the low-cost microcomputer became available, and many people, who previously had no access to computers, became proficient in microcomputer use.

This was true in our department, and I began to receive ideas from the field and from my own staff on how microcomputers might help in the administration of the program. Their responses were rather intriguing because the same people who had always spurned the printouts from the main office computer as being worthless now seemed to be saying that printouts from their own microcomputer would be priceless.

In any event, they got my attention; and when I learned that at least two residencies had acquired use of privately owned micros (Apple IIs) and were using them for state business, I knew I was hearing some truth. To further my own knowledge, I completed a home study course for managers on the microcomputer. This course reinforced what I had been told by several computer people; that is, that potential microcomputer users, in this case our resident engineers, should define carefully the problems they think can be solved by using micros. Next, they should find software that might be used to solve the problem, and then hardware that would run the software. We decided to follow this course.

It was obvious that the people best suited to define the problems were the people who had the problems, that is, our resident engineers. We have a significant advantage here, because all of our 68 resident engineers are licensed professional engineers. Therefore, it was easy to find four competent ones who had a strong interest in computer technology to form a committee to carry out a pilot project. To these we added a man from my office, who had had computer experience at the main office. He acted as secretary for the committee and kept me informed of their progress.

The next step was to require each member of the committee to take the same home study course on micros that I had taken so that everyone would start with a common understanding of the management problems. As a result all committee members quickly accepted the premise that they would have to define potential uses for the micro, find the software, and then the hardware. Between October 1982 and March 1983, they isolated six significant uses for the microcomputer:

1. Payroll changes,
2. Word processing,
3. Financial account keeping,
4. Personnel information,
5. Material inventories, and
6. Accident damage collection.

The software selected to solve these problems was D-Base II, PeachCalc, and Wordstar. This software, at that time, required a control program for microcomputers (CP/M) operating system in the computer. The computer selected was the Tandy TRS-80 Model 12 Computer with Anadex Model 9500A printers.

We acquired a set of software and hardware for each of the four resident engineers on the committee for use in their offices, which were scattered throughout the state. Also each committee member agreed to develop by November 30, 1983, a computer program to solve one or two of the six uses, and

they all agreed to implement all six programs by December 30, 1983.

These assignments and deadlines were put in writing to them so that their tasks and deadlines were clear. All six programs were written and implemented by the deadline of December 30, 1983.

At this point, we ran into a bit of a delay in that NYSDOT as a whole had not stood still concerning microcomputers. There was great interest in micros by other program areas and several different micros were being acquired by different programs. This forced our administrative staff, who have overall responsibility for computer support, to insist on a common operating system for micros to facilitate the exchange of computerized information. They decided on the MS/DOS operating system, which runs the IBM PC and several other makes. Up to that point all the committee's work had been based on the CP/M operating system.

Therefore, the committee had to convert the software they had developed and acquire hardware that could use the MS/DOS operating system. The committee decided to use a new microcomputer on the market, the Tandy TRS-80, Model 2000. This machine uses the required MS/DOS operating system and is a faster machine than the older Model 12. At the same time, it was decided to adopt a new printer, the Okidata Microline, Model 93P.

The committee modified their programs so they could be used with the Tandy TRS-80 and eight useful menu driven programs have been developed for direct application at residency level. Six more are being developed.

One example of a useful program is the payroll change program. Our payroll system is set up to print out the same checks to the same people unless it is instructed to change. The residency is responsible for initiating changes for their staff; this is a large, repetitious, and tedious task, especially in the winter when all of the blue-collar employees are earning overtime on snow and ice control. It was common for residency clerks to spend 15 man-hours per biweekly pay period on this task. With the micro, this work is reduced to 1 man-hour. We feel this one program application will pay back the cost of the hardware in a year.

The committee's work showed that micros can be used successfully at the residency level, so successfully, that once installed, they become almost indispensible. Consequently, we plan to install micros in 38 residencies this year and the remainder in 1985.

In summary, we have been successful by following the procedure of defining possible applications, finding software that should do the job, and then matching hardware to the software.

We were also successful because the users developed the programs to meet their needs; nothing was imposed from above. We were fortunate in having intelligent, technically trained, enthusiastic users, who had the capability of effectively putting micros to work.

In closing, I would like to give credit to the members of the committee. They are

David Palma, Saratoga residency;
Richard Bassler, Cortland residency;
Fred Ames, Steuben-Chemung residency;
Chet Moody, Cattaraugus residency;
Albert DiCesare, Niagara residency; and
William Dixon, main office.

Merging Construction and Maintenance Activities in South Dakota

WILLIAM M. GERE

South Dakota is responsible for maintaining some 18,500 single-lane miles of highway and administering the activities of contractors on an average of 250 construction projects annually.

In the fall of 1980 because of continued pressure to reduce the number of department employees, it became obvious that we were going to have to reorganize to provide adequately staffed and trained construction inspection and maintenance crews to handle the work assignments.

We reviewed the last 8 to 10 years of our maintenance activities and determined that we were adequately staffed in the rural areas at the rate of 20 two-lane miles per maintenance worker including a foreman and 15 two-lane miles per worker in urban areas. The construction inspection and engineering staff need was being planned by a construction engineering management system that had been initiated in 1979 and a 5-year construction program that we were reasonably comfortable with.

The South Dakota Department of Highways was established in the late 1930s. It was organized into five districts with a district engineer in charge of each district, and the mileage assignment among the districts was reasonably equitable. In 1974 the South Dakota Department of Transportation was created.

As a general rule the maintenance work was assigned on a county basis with at least one maintenance crew with a foreman in charge in each county. In some of the more densely populated counties with a greater number of miles of road there were two or three maintenance crews.

Construction engineering and inspection was assigned to an individual identified as the resident engineer with a crew of professionals and subprofessionals varying in number depending on the amount of work. In the early 1950s we had 30 to 35 of these residencies looking after construction work and 90 to 100 maintenance crews. With the advent of Inter-