

# Making the Change to Maintenance Management Systems and Optimizing the Results

T. G. B. ARMITAGE

The introduction of a maintenance management system (MMS) into a roading organization is a significant organizational change. The theory behind making change is examined to establish the ground rules for successful change, highlighting the importance of *ownership* of the change. Examples are given of the application of those rules from work in Australia and New Zealand. Better management information is only one type of enhancement needed to improve organizational performance. Other work required to enhance the results of an MMS includes specifying the best maintenance methods and training people in them, and developing the technical and managerial competence of supervisors and managers to strengthen the quality of decision making and to provide appropriate management support for the MMS.

In Australia and New Zealand, there is considerable work in the development of pavement management systems (PMS) and maintenance management systems (MMS) for roads. Many organizations have had types of manual systems for years, but the advent of computers allows much more sophisticated systems to be available to everyone.

There are many advantages of an MMS, and persons involved with design and application of such a system generally understand these advantages. However, this knowledge is not necessarily shared by personnel in the field who are the ones affected by use of such systems.

Changes in government policies in New Zealand are forcing traditional roading organizations to become totally commercial, and in both countries increased productivity is becoming an important part of public corporate life. The pressure is on road maintenance organizations to improve performance and justify their share of public funding.

Roading organizations normally make changes in small increments. So for many field personnel unaccustomed to systematic planning, the introduction of an MMS may pose the most significant change of their working life; demanding a change in attitude towards work planning accompanied by the acquisition of new skills.

Most people feel uncomfortable when faced with a change from existing work practices; they tend to resist the change and return to the status quo. For this reason, the most well-intended and important change can have a limited effect and a short life, even after it has shown significant initial benefits.

It is critical to the successful introduction of an MMS that the field personnel not only know all about the system and understand its advantages for them, but also that they are

willing to use it. It is equally as important that the change makers understand the basic constituents of developing and introducing successful change.

## THEORY OF ORGANIZATIONAL CHANGE

In considering organizational change, it is useful to examine the fundamental systems that operate within an organization.

Leavitt (*1*) considered organizations as "multivariate systems, in which at least four interacting variables loom especially large." He identified these four variables as

- Task. Ranging from the main reason for the organization (e.g., road maintenance) to the actual work done (e.g., repairing edgebreaks).
- People. Those carrying out the tasks.
- Technology. The technical tools and systems used in problem solving and carrying out the tasks.
- Structure. The systems of communication, authority and work flow.

Leavitt postulated that the "four are highly interdependent, so that change in any one will most probably result in compensatory (or retaliatory) change in others."

## Structural Change

In New Zealand, the creation of state-owned enterprises (SOEs) has usually been accompanied by restructuring in the affected organizations. The move to decentralize SOEs has affected people by giving them more accountability for managing their own profit centers. By concentrating on their core task, the SOEs have eliminated peripheral activities and consequently down-sized (i.e., made people redundant).

For example, the new Telecom organization restructured into five autonomous regional operating companies and several special purpose companies (e.g., international tolls). The companies have eliminated activities such as building construction, furniture manufacture, and vehicle servicing to concentrate on their core activity—telecommunications. New computerized accounting procedures (a technology change) will affect people (through redundancies and retraining), tasks (the type of work will change), and structure (communication systems will change).

Usually these changes have been introduced without consultation, against the belief of people-oriented practitioners that "human acceptance of ideas is the real carrier of change; and that emotional human resistance is the real road block" (1). In the case of SOEs, however, emotional human resistance has not been an impediment to change. The change itself has been so overwhelming that it has surpassed human feelings. It has involved the fundamental change of the whole organization, rather than improvements within the existing organization.

The situation is different when a manager is trying to make change within an existing organization. The Hawthorne study (2) found that people react well to change if it is discussed with them in advance, and subsequent experience continues to support this positive note. Peters and Waterman (3) found that the excellent companies owed much of their success to their people-oriented approaches.

### Technological Change

A new management system can be considered as a technological approach to organizational change. The most famous (or infamous) precedent in the area of technological approaches is Taylor's *Scientific Management* (4), which began early this century. Pilloried as inhuman, it created a separate planning specialist, thus removing the planning role (and with it the right to choose) from workers and their supervisors.

The perception of management systems is little different from that of scientific management. The problem is that the "technological and structural approaches tend to focus on problem-solving, sliding past the microprocesses by which new problem-solving techniques are generated and adopted" (1). This statement suggests that the developers of the new systems have not recognized the need to work with the end users during development, so that the system will meet end user requirements and be readily adopted by end users. Unfortunately, this negative factor continues to be the case with some developers of management systems.

### People Change

More than 50 years ago, Carnegie (5) considered that the relationship between changer and changee was critical to successful change. He considered that changes in feelings and attitudes were prerequisites to voluntary changes in overt behavior. His model is manipulative because he built good relationships and then bargained with them.

A more acceptable method, used by Coch and French (6) to introduce changed methods in a pajama factory, was to use group methods. They provided the opportunity for need satisfaction, then directed the group forces towards the desired change. In both these approaches, the power is in the hand of the manager wanting change; they are similar to the Theory X authoritarian management style outlined by McGregor (7).

Later researchers (8) placed great emphasis on the need for collaboration between changer and changee for change to take place. This attitude parallels McGregor's concept of the participative style, Theory Y; it provides a major shift from

the powerful superior dealing with weak subordinates to a more equal balance of power.

In a development of Theory Y, individuals are encouraged to set their own objectives. This has been termed "management by objectives" (9) and demands a greater degree of leadership and competence from the individuals' managers (10) than the more conventional Theory X style.

### Task Change

Road maintenance organizations seldom undergo substantial changes in the tasks done. But they should have built into their task system a strategy of continually examining current methods to identify where improvements can be made. Improvements may require training (an important element in the people system) and changes in technology.

### Review

The message from the research and emerging management practices is clear. In order to ensure its success, an organizational change must

1. Be the result of collaboration between the promoters and the final users, and
2. Assist users to carry out their work, improving the quality of their decisions—not making them.

This attitude is in stark contrast with the popular perception of some MMSs, for example. Supervisors at every level and some engineers have privately expressed the fear that an MMS will increase their paper work, computerize their planning function, and remove the need for them to use experience and judgment, and that it will be developed without full consultation with them.

Unfortunately, their misgivings have some foundation in (even recent) history. Systems have been introduced with little or no input from the users and insufficient thought to the best method of implementation. In addition, some systems reduce rather than enhance the quality of decision making, because they take it away from the practitioner. Although such a system may have some relevance in a factory setting where most conditions remain constant, conditions in roading are so variable that decisions must be made by competent, experienced people.

These variations can range from political forces altering budget decisions to changes in planned repair procedures once the road is opened up. Each variation requires a person to have the authority and ability to make judgments aided (but not constrained) by a management system. The system must be considered as an aid to better decision making.

In the past, the importance of the ownership of change may have been underestimated. Researchers have concluded: "A great deal of change seems to demand participation, especially at the implementation stage" (11); "When ideas are a person's own, they are much more likely to be translated into meaningful practices than when they are the suggestions of an outside expert" (12); "A cardinal value of organizational development is the introduction of shared or distributed influ-

ence—based on the assumption that people will be more committed to objectives if they have participated in establishing them” (13).

### ORGANIZATIONAL CHANGE—PREVIOUS PRACTICE

In the past, the changes to management information systems have most often been “head office driven”, to meet corporate objectives. Frequently, foremen and overseers have reported that they have been required to provide regular information for the latest corporate-inspired system.

Commonly they report a lack of feedback. Recently an overseer reported that he had been asked to provide daily information for a new management system. He continued this extra effort for 2 years, but received no indication that his effort was appreciated nor had he received any benefit from it. So he stopped, and no one has spoken to him about it since—either to ask him why he stopped or to ask him to continue. His reasonable perception is that his effort was of little value to the organization. Naturally, he was a reluctant starter when the organization introduced a new management system.

This experience is by no means unique. Supervisors who are affected feel that such experiences badly reflect on the organization and managers who initiate unneeded systems.

Quite reasonably, system development has concentrated on the need to provide certain management information. But even the best system is of little long-term value if the people using it (or providing information for it) do not understand its importance to them. So an important part of system design should be its introduction and long-term support.

### ORGANIZATIONAL CHANGE—THE PROCESS

The overall model for making change need not be complex. An example relevant to roading is shown in Figure 1.

1. The first step is to identify the change to be made; e.g., the organization wants to introduce an MMS.
2. The systems and procedures inherent in the change must be developed, and appropriate standards set against which the outcomes of the change can be evaluated.
3. The work affected by the change must be identified and itemized in sufficient detail that the individual activities and their constituent work methods and skills are specified. This enables work standards to be set. Changed work performance can be measured against these standards.
4. Finally an implementation process should be designed to introduce the change to the people affected by it and to ensure that the change continues as part of the new corporate culture. This process must include training to ensure that the people affected by the change will feel comfortable with it and will be able to use it to their advantage.

The mechanical processes of system design are well understood and have been practiced for many years. However, recent work has attempted to improve the human side of

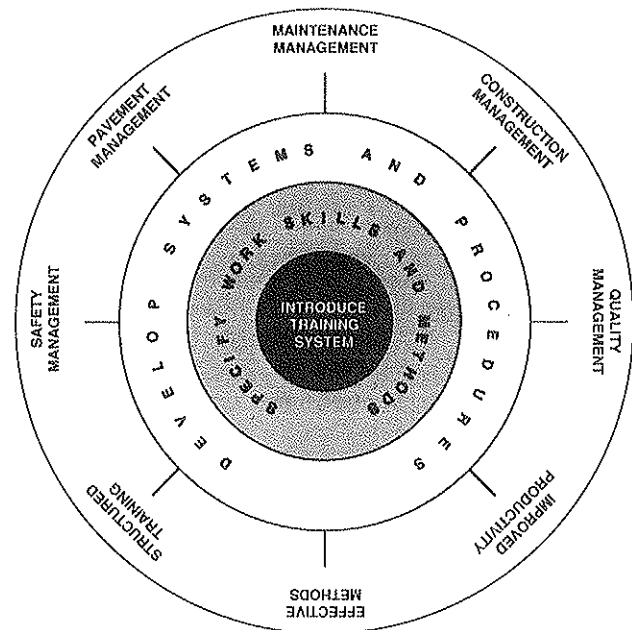


FIGURE 1 Developing structured improvement.

introducing the change, by influencing the people who will be affected by it and making the change process more acceptable to them.

Change in people is not as simple as changing direction in a vehicle. Change can be mentally uncomfortable, even threatening to a person. It is not a mechanical process like turning a steering wheel or programming a computer; it works on the human mind, so the human reaction to change is tempered by nonmechanical, psychological factors such as attitude and motivation.

Merely handing out the operation manual or sitting someone in front of a computer terminal may not instantly produce the desired change. People must perceive that the change will benefit them and, preferably, experience that benefit as part of their training. Then they may make the mental adjustment necessary to accept the change.

Thus, the training to support a desired change may have to concentrate more on changing attitudes than on the new system or procedure itself. The training provided is likely to be a critical part of the change process, making the difference between success and failure.

### DEVELOPING AN MMS

The Queensland Department of Transport is developing an MMS for its roads. Development is being undertaken at corporate level, but the organization is keeping its works districts involved and informed. Districts are subjecting parts of the system in trial during development to ensure they will work and are user friendly. Trial districts are gaining a sense of ownership of the final product because they have contributed to its development. The system has been described by Caldwell (14).

## Activity Descriptions

A basic part of the system is a series of activity descriptions—definitions of the tasks used to repair defects. These are the activities that the system manages.

Each description includes the method, materials, plant, and workers required as well as other planning information such as intervention level, restoration standard, and average daily production. The descriptions set out the quality and safety standards for the work and indicate the skills needed by the workforce.

Rather than write these descriptions corporately and without reference to the final users, the organization asked a cross section of maintenance engineers and supervisors from a number of districts to do this in a 3-day workshop. Another open objective of the workshop was that participants should have a complete understanding of the MMS as it affected them, to understand its advantages to them so that they would accept ownership of it.

Subsequent evaluation indicated that the workshop met its objectives, so that a nucleus of the organization was willing to use the MMS. The workshop was designed and run using training methods.

## Work Methods

In particular, the workshop gave activity descriptions on the basis of practices generally acceptable in the districts represented. However, the corporate descriptions are only a stepping stone; each district is encouraged to review them and alter them where necessary to ensure they represent the best way of doing the work in the district. In this way, responsibility for setting and maintaining standards (within wider guidelines) devolved to the districts where the work is actually happening, and the districts develop a sense of ownership of these standards.

Most of the activity descriptions represent changes to existing methods, but nothing will change until staff are trained in the new methods. Once a district has written its own activity descriptions, it can begin to train its staff in the new work methods. This training effort alone should provide significant improvements to standards and several other benefits to the staff and organization (15).

The final phase of the work, introducing the system to the districts, will also involve staff training in the use of the system itself. It will come at a time when districts will have seen some of the benefits from the skills training. These benefits will have reinforced their belief that the system as a whole will also benefit them.

## A Champion

The development work for the MMS and the associated supervisor and worker training has been strongly supported by the districts. But even then there must be a word of caution. The initial commitment to this change must continue actively in each district, otherwise the change will have minimal long-term effect. Even though a change may have been successfully introduced, there are many forces working against its survival.

For example, the champion in one district may retire, leaving no one there to take up the role; priorities alter (with a new boss or a run of bad weather), and the MMS may be placed in abeyance temporarily, but never restarted.

The best insurance against loss of momentum is the appointment of a champion, someone (in a large organization at least) whose sole function is to keep commitment to the change high even when there are many other competing changes in the organization. In New Zealand, a system of worker training was introduced into the Ministry of Works and Development (MWD) in 1986 (16). Since then, the MWD has been restructured into a commercial SOE and undergone subsequent restructuring.

With such extreme changes in such a short time it would be surprising indeed if the training system had survived, but it has. The MWD assigned a staff member to work on the introduction stage, and initially that person's sole responsibility was to keep the system working. This meant a continual round of visits to managers, acquainting new managers with the training, and retaining the commitment of existing managers. Training in instruction techniques has been provided for new overseers and foremen, and it is being extended into other interpersonal skills required for roading supervisors.

A similar appointment has been made in Queensland, to continue the training and motivating work needed to ensure the long-term success of this significant change.

## SUPPORTING AN MMS

On its own, an MMS enhances the quality of decision making in the organization—it cannot improve actual work performance in the field. Such improvement requires the best appropriate methods to be decided and workers to be trained in them. Supervisors must also be trained in those methods so that they can properly supervise the work. In addition, supervisors must be able to plan and organize work (where that is their responsibility) and to lead the work group on the site (if that is their role).

In Queensland, a model was developed outlining the material and training required to ensure that introduction of the system would actually improve field performance. This model is shown in Figure 2. The argument is that two things are required before there can be effective planning of work: the organization must not only specify the work activities but also train supervisors in planning and organizing work. If either the specification or the training is omitted, there cannot be effective planning.

Each activity description includes the best appropriate method for doing the work in each particular district. Supervisors require leadership and site supervision skills to control and motivate workers before those method specifications can result in effective work.

The methods are broken down into their constituent steps and skills. Separate skill instruction guides are being written to cover the large range of skills required by people in the department. Supervisors must be trained to instruct their workers so that these skill specifications can be used to improve the safety and quality of the work being done.

The result of all these steps combined will be improved productivity. These specifications and the training will also

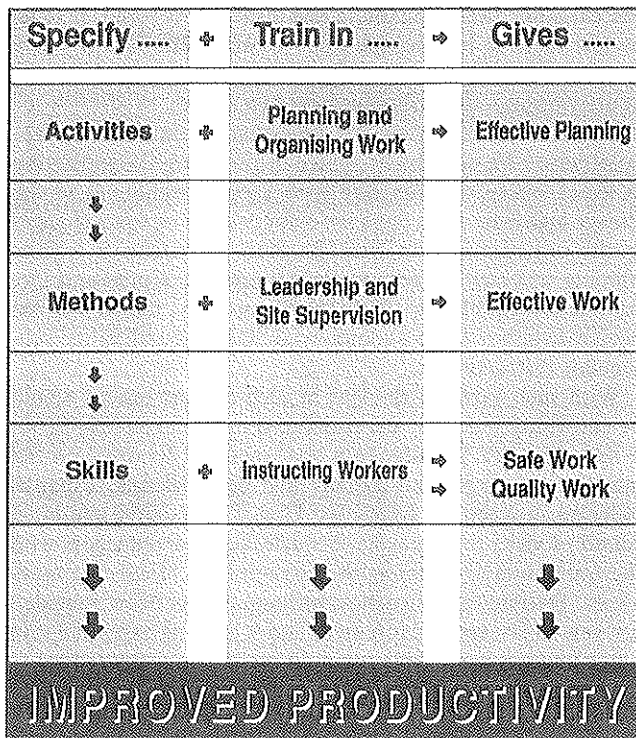


FIGURE 2 Improvement model for Queensland.

allow the department to meet its statutory obligations for safety under the State's Workplace Health and Safety Act and to implement a policy of total quality management.

#### Best Local Methods

Part of a road maintenance worker training project in New Zealand (17) was designed to specify methods that represented the best practice nationally. Comments on draft methods were sought from representative samples of practitioners throughout the country before final recommendations were written.

It was recognized that there would be regional variations because of varying local conditions, maintenance standards, and available resources. So engineers and field people were encouraged to work together to develop their own local methods on the basis of the national recommendations. A similar approach has been used in Queensland. Also in Queensland, works districts have been encouraged to write skill instruction guides themselves. These are forwarded to the corporate office for checking and coordination, then distributed to all districts.

A variation is being subjected to trial in the Roads and Traffic Authority of New South Wales. Here a technical team is being formed in each works office to determine the best appropriate local method and skills. Each team has about five members, representing the works engineer, foreman, ganger, leading hand, and worker levels.

They will subject new methods or procedures to trial in one crew first (generally in a crew with a representative on the technical team so that it has some ownership of the method it is testing). When the method has been tested, all affected

supervisors will be trained in it; then, they in turn will instruct their own workers.

In New South Wales, work practices must comply with the state occupational health and safety legislation, whereas a recent Commonwealth act requires employers to provide training equivalent to 1 percent of employee's time. The technical team work and the ensuing training will allow compliance with these two requirements and provide an excellent base for the MMS being introduced throughout the Roads and Traffic Authority in 1991.

#### Appropriate Training for the Organization

Most training is designed to meet the needs of the individual. Its objectives are expressed in terms like ". . . each participant will be able to . . .". In other words, the training should change the individual's potential to perform, but it does not consider how that potential can be harnessed to actually change performance in the workplace. This step presumably is left to the individual's manager. Although this procedure may be good for the individual participant, it does not necessarily help the manager whose objective may be to change organizational performance.

An extreme example of how this approach can go wrong happened in a shoe factory. The owner-manager sent four of his supervisors to a personal motivation course. The course motivated them to the extent that two supervisors resigned from their job immediately and the other two within a year. Unfortunately for the owner, the course was successful on an individual basis, but it was not related to the requirements of his organization. He was unable to change his organization to take advantage of the supervisor's new level of competence.

So what should the owner have done? The second time around, he engaged a training consultant who analyzed the supervisory performance problems in the factory, designed an approach to overcome those problems, then worked with all the supervisors and managers to implement the approach. This approach included training that improved individual performance and attitudes and built a stronger management team. The team openly discussed long-standing problems within the factory. Most of these related to poor communication between supervisors and managers, and the stronger team quickly identified solutions for them.

This example indicated that a trainer and manager could work together to provide in-house training, designed to make specific improvements within the organization. In fact, of the several shoe factories that had operated in that city in the early 1980s, the factory just described became the sole survivor of their common economic problems.

Training can be most powerful when it is used to support planned changes in the organization. This could include training someone for promotion and training a group in new methods or procedures. It is particularly powerful when used as a basis for the attitude and skill changes required for the successful introduction of an MMS.

#### Appropriate Individual Training

Training must be presented in a manner appropriate to the individual learners. In one organization, engineers reported

their apprehension at having to present lectures on "foremanship" to supervisors. The lectures (called "seminars") were presented to a strict format and timetable with the use of slides or overhead transparencies. The engineers were nervous about standing in front of a group and lecturing to them.

What the engineers did not realize was that the supervisors were equally as uncomfortable. As a general rule, practical, outdoor people do not enjoy listening to lectures for an hour or more inside a room. Participative training is the most appropriate form of learning for adults. The lecture method, by which most engineers have been taught, is probably the least appropriate. Certainly, changes in attitude and manual skills are best developed by actual experience.

Learning to drive a motor vehicle is a good example. People can learn the theory—a knowledge of the road traffic rules—by reading a book; they have to be in a vehicle to learn and develop the necessary driving skills. Also, driving experience and practice are the only way people can fully appreciate the application of the road rules and become confident, safe drivers. Unfortunately, the supervision of drivers is too loose to ensure that people continually maintain standards and attitudes conducive to safe driving.

Exactly the same procedure should be followed when learning the skills and developing appropriate attitudes to work productively. The only difference should be the standard of supervision after training.

The highly participative approach normally used by the author comes as a shock to many participants, who are used to trainer-driven training. In this approach, the participants set the times for the training, spending as long discussing a subject or doing an exercise as they need; they make their own decisions on matters under consideration. The trainer's role is to guide the learning along logical paths, to stimulate discussion, to set exercises suitable for the learning, and to ensure all participants are gaining from the experience.

### Testing the Training

Another important feature that receives continual commendation from training participants is a follow-up assessment visit. The training provider visits participants and their managers after the training to assess the participants' competence in their workplace. Typically, this involves a formal assessment of the participant using the new skill. This follow-up visit allows the trainer to assess more clearly that the training objective has been achieved, it allows individual coaching where needed and gives managers and participants the opportunity of discussing how the new skill can be used in the workplace.

It allows the provider to assess if the training was appropriate for the organization and the individual learners.

Field people in particular gain visibly from this visit. For most of them, it is the first time they have been tested at work. Often their record at school was one of failing, so passing the assessment gives them a real sense of achievement and confidence in their ability to learn. It may be remembered that some school examination results are scaled so that 50 percent of examinees will fail. The objective of training should be that all will pass; if they do not, the training, not the learner, should be reexamined.

Most participants enjoy this positive approach to relevant, participative, and tested training; and they begin to request more of it.

### FIELD STAFF TRAINING

Training for field staff can be divided into four areas: worker training, operator training, supervisor technical training, and supervisor interpersonal training. Each has different requirements, requiring different approaches to ensure success.

#### Worker Training

The worker training system developed in New Zealand (17) was designed specifically to meet the requirements of road maintenance. Instruction is given on the job (not in a classroom), using actual work; instruction is by the workers' own supervisors; and the methods taught have been previously selected by local supervisors and engineers. This process ensures that workers (and their supervisors) learn the best methods appropriate to their conditions, in a setting in which they are at ease and from a person with whom they are in daily contact.

Instruction of workers by their own supervisors improves the relationships between them, builds a better work team, and removes the chances of misunderstandings introduced by a third party. The related principle is that supervisors who do not have the ability or time to instruct workers also do not have the ability or time to properly supervise their work.

A significant advantage of this system is that it uses existing resources within the organization, so it is exceptionally cost-effective. Other benefits as perceived by users have been recorded (16), but no quantitative benefits have been studied. In 1989, the training system was introduced into the Department of Transport (Queensland) and Roads and Traffic Authority (New South Wales). In recent work, Thomas and Anderson (15) have quantified the effects of improved methods and training in pothole repair. Their study found that introducing a standard repair procedure decreased the repair cost per ton by 44 to 48 percent when taken over the life of the repair. Training then decreased the cost of the standard procedure by 45 percent. The total savings was nearly 70 percent on the original "throw-and-go" method.

The longevity of the repairs improved from 60 to 899 days (average). This increase not only yields dramatic reduction in cost but also correspondingly boosts workers' sense of self-worth. The defect is repaired only once, not six times a year.

In addition, the study found an exceptional saving of resources, with the amount of material placed in potholes each year reduced by 62 percent in 5 years. The study concludes that "Training programs and the proper selection and standardization of equipment can significantly reduce overall costs. . . . The factors that have the greatest influence on total repair costs are repair longevity (procedures), daily production, and crew deployment practices."

This argument for better methods and work skills, combined with better management, is powerful. With such savings to be made, the question is not "How can we afford training and MMSs?", but "How soon can we get started?" The answer must be "Now."

## Operator Training

One of the important features of the worker training in New Zealand (17) was that workers should be trained by their own supervisors. This principle cannot be translated to operator training. The operation of plant equipment such as graders, computerized bitumen sprayers, large rollers, and others, requires specialists. It is unreasonable to expect that supervisors should be skillful operators of the wide range of plant equipment used in road maintenance. However, they must know the standards of work expected from a competent operator and the correct methods of using the plant equipment to achieve those standards.

In the past, there have been few successful attempts in New Zealand to provide operator training. This fact is rather strange considering the replacement and running costs of the plant equipment and its potential to create or ruin a good road. Although all bitumen sprayers used on state-subsidized sealing work in New Zealand must be certified every second year, the operator whose ability influences the standard of the work faces no such requirement.

Operator training is best carried out by a specialist operator who also understands the principles of instruction. The person could train operators on the job, ensuring that both they and their plant equipment come up to acceptable standards. The other way is for the operators to come together for a training workshop. In this way, they can compare techniques and learn from each other as well as the specialists.

Several years ago, a Gold Grader Competition and Training Workshop was conducted. The event took place over 2 days, with training not only for beginners but also for experienced operators in operating skills, machine maintenance, safety, and correct use on the road. As a follow-up, the participants requested (and received) a 1-day workshop on maintenance. Most participants stated that it was the first organized training they had ever received. No attempt was made to evaluate the success of the training, but the participants displayed an increase in skill level during the workshop.

Once again, the training was designed to meet the requirements of the participants and their organizations.

## Supervisor Technical Training

In addition to the basic worker skills, road maintenance supervisors must have a second level of knowledge and skill. They must understand the basic requirements of good road maintenance and be able to apply these in the field. An important part of this second level is the inspection of roads to identify defects and their causes, then to specify appropriate remedial measures.

In New Zealand, technical workshops for supervisors are typically run over 2 days. The workshop content is 50 percent discussion and 50 percent field work. It has four parts: discussion of some basic principles, making a road inspection and deciding the work to be done, doing that work, and a final summary session. The most frequently run workshops are Maintaining Sealed Pavements, Maintaining Unsealed Roads, and Maintaining Drainage for Roads. They are based on National Roads Board publications (18–20).

At an individual assessment visit later, the trainer observes each participant inspecting a road and specifying repair work. Then there is a discussion with participants and their managers on the results of the assessment and on ways to ensure that the new skills will be used. Informal evaluation of results (subsequent discussions with participants and their managers) indicates that the workshops provide a useful learning experience and that the learning is transferred to actual performance in the field.

A similar approach has been adopted for the training of engineers, technicians, and senior supervisors in chip seal design and supervision.

## Supervisor Interpersonal Training

Unfortunately, the project to provide interpersonal skills training for road maintenance supervisors in New Zealand has made slow progress since mid-1986. The concept was that training would be provided through a series of supervisor development workshops on the subjects of supervising workers, planning and organizing work, personnel management, and safety. Participants would leave each workshop with exercises that they would do with their managers' supervision. A coaching workshop was proposed so managers could better understand and carry out their coaching role for the workshops.

If the managers are not involved in this way, there is no guarantee that the new competences will be exercised usefully for the organization. Indeed, one organization has reported that its supervisors (who have been trained by an internal consultant) have gained interpersonal skills and understanding superior to their managers, thus weakening (rather than strengthening) the relationships between them. In the worst possible situation, people were encouraged to leave the organization because they had outgrown it (as in the shoe factory noted previously).

The concept of the manager as a coach is part of modern management philosophy (21). This concept was used as part of the system design for the supervisor development workshops. Also, it was expected that by being involved managers would better understand (and themselves gain) the competences learned at the workshops. This understanding would enable them to make better use of those competences in the workplace.

It is critical for the success of interpersonal training that managers are involved, not only in developing training that is appropriate to their staff, but also in working with their staff to ensure that the new competences are actually used.

## Management Training for Engineers

In New Zealand during 1989–1990, local councils (which maintain much of the country's roading system) underwent massive change. Over 230 existing councils were amalgamated into just 75. Positions such as Works Engineer and Roading Engineer were typically redesignated Works Manager and Roading Manager. The emphasis in such management positions is now on management more than technical qualifications and experience.

Several organizations in New Zealand provide training for managers. When it decided to develop industry-specific training for supervisors and workers, the Local Government Training Board considered that management training need not be specifically designed. Management skills are more generic than industry-specific, and management requires people with greater conceptual skills than supervision, so they must be able to transfer skills learned in the context of one industry to another.

Management of change is becoming an increasingly demanded skill for managers; it is particularly important in relation to the introduction of an MMS. Managers must be able to create an atmosphere in which people will change entrenched attitudes towards work management and people (often unused to training) will learn new skills of planning, organization, and leadership.

### Technical Training for Engineers

Publications and conferences provide opportunities for road engineering engineers to improve their technical knowledge and glean the results of research and innovative practices on a reasonably frequent basis.

However, one of the difficulties with research (and conference proceedings) is converting them into actual changes in the workplace. Often, there are long delays between an idea or the results of research and their application. Lay (22) noted "It has commonly taken about a decade to develop it (an idea) to a useful form."

The National Roads Board (now part of a new Transit New Zealand) has recently encouraged researchers and others to present training workshops or seminars that are based on their work. This policy means that the information is disseminated more positively and faster than before. It also means that there can be two-way communication between researchers and a wide range of practitioners, perhaps improving the knowledge of both groups.

In 1988, the National Roads Board supported the design and presentation of training workshops on the maintenance of unsealed roads. This policy was proposed to disseminate the information published (19) as a result of research into acceptable practices. The project was undertaken by Ferry, Armitage, and National Roads Board staff.

The research had recommended fundamental changes in the design, construction, and maintenance practices commonly used throughout New Zealand for unsealed roads. Two workshops were designed to cover the range of personnel levels identified as contributing to the decision to change organizational practices. There was a management workshop for policymakers, managers, and technical staff, and a maintenance workshop for field staff. As part of the project, a video was made to help change attitudes towards unsealed roads practice.

The management workshop was 1 day of group discussions and practical exercises to get normally desk-bound people involved in the consequences of their decisions. The management workshop was run about 2 to 4 weeks before the maintenance workshop in each particular location so that managers could confirm and discuss an action plan for changing their practices before they sent field staff to the second workshop.

The maintenance workshop was for supervisors and grader operators. It followed the format established for similar technical workshops. On the first day, participants discussed principles, then inspected some roads for faults; on the second day each group worked on a length of road, bringing it up to an acceptable standard.

The final stage was a follow-up visit by the researcher. He assessed the competence of the field staff in inspecting a road and specifying remedial work for it. He then discussed their action plans and proposed practices with the field staff, engineers, and managers. It is too early to judge the success of this approach in changing existing practices. The initial reaction was positive, but it is the long-term results that are important. A workshop for engineers titled "Economic Analysis" has also been based on recent research work (23).

This type of approach can decrease the time delay between research and its effect on practice. It is a positive approach for providing technical training for engineers and changing field practice.

### CONCLUSION

Change can present physical and emotional challenges to the people affected by it. Increasingly, managers are recognizing the importance of involving those people in the development and introduction of the change so they will develop a feeling of ownership of the change rather than resent it as an imposition.

Management information systems will enhance the quality of decision making if properly developed. However, better decision making with a road MMS does not unequivocally lead to improved performance on the road. First, the best methods, appropriate to the circumstances, must be determined; then workers and supervisors must be trained in those methods; supervisors must be trained in site leadership and planning (according to their particular responsibilities); and managers must be able to support the required changes in personnel responsibilities and attitude before the full benefits of an MMS will be realized.

All of these processes certainly do not happen overnight—they require long-term effort, with strong management support to persevere.

The research and experience considered indicate that training can be used to advantage in a roading organization: to support organizational changes such as installation of MMSs, to improve the technical and managerial competence of supervisors and managers, and to give workers the basic skills needed for the organization to improve its work performance.

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