

TRAINING OF MAINTENANCE PERSONNEL

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In California the complexities of administering the expanding highway maintenance function created a need for additional and more comprehensive training of both management and line personnel. A task-force approach was utilized to determine current and future training needs of highway foremen, landscape foremen, and superintendents. Traditional approaches of lectures and short courses were discarded, and live-in academy methods using realistic settings and training material were adopted for maintenance supervisors. Gathering many and varied supervisors in the academies identified additional training needs. Supervisors must be trained to become people managers if they are to become efficient maintenance managers. This need is being met by a basic maintenance supervision course that is now being implemented. To supplement on-the-job training, various correspondence courses have been developed. They are presently being taken by 2,700 road and landscape employees; another 400 employees have completed the courses. California's goal of reducing maintenance costs is being met by increasing employees' knowledge and understanding of maintenance operations.

•A FEW years back, the California Department of Transportation took a long, hard look at its maintenance operations. We found increasing complexities and problems in meeting work load requirements within budgetary limitations.

Consider, for example, the growth of the job brought about by more lane-miles, more structures, and more landscaped areas. Although improved technology allows some of the work to be done faster, the unit cost of labor and materials is rising and the number of dollars available is not growing as fast as the job. Heavier traffic volumes make maintenance more difficult and time-consuming. In addition, the public wants higher maintenance standards, more consideration to aesthetics, environment, and ecology, and more snow-country lane-miles kept open all winter.

Protection of the huge investment in the California highway system requires a vigorous maintenance program and organization. To provide such a program, the state is divided into 11 transportation districts. Each of the districts has a self-contained maintenance staff as well as staffs for other functions such as planning, design, right-of-way, construction, and traffic.

Staff responsibility for maintenance is vested in the district chief of operations and the district chief of maintenance. The chief of maintenance in turn supervises the district office functions and the various field superintendents, who are strategically located throughout the district. Each field superintendent is responsible for the supervision and direction of effort of a number of field crews, depending on the quantity of inventory to be maintained and geographical area covered.

The average field superintendent in the state is responsible for maintaining approximately 215 centerline miles and supervises about 55 general maintenance employees. The average foreman maintains approximately 48 centerline miles with a 6-man crew. Generally, landscape foremen and their crews are assigned to superintendents and are responsible for maintaining landscaped areas. Each district has a special crews superintendent who, with foremen and crews, is responsible for maintaining specialty items such as pavement delineation, signs, signals, lighting, tunnels

and tubes, ferry and drawbridge operation, and bridge repair. At present there are 81 superintendents' territories and 515 crews, generally supervised by foremen. In Sacramento, the headquarters maintenance branch provides functional guidance and responsibility for district operations on a statewide basis.

In a few cases, highway superintendents in metropolitan districts are supervising more maintenance people than there were in a small rural district's entire maintenance department not many years ago. With the expansion of maintenance departments to handle the work load created by accelerated highway construction, including the Interstate program, and new concepts of highway beautification in the form of extensive highway landscaping projects, the opportunities for advancement in the maintenance field are greater than in previous times. Superintendents and some foremen have grown up with the expanded program. However, the fact remains that maintenance people are now advancing with fewer years of service and with less opportunity to become exposed to the many problems of a supervisor.

This places an increasing burden on maintenance forces, particularly on superintendents and foremen. It appeared that additional training of these supervisors was necessary to meet current problems and to cope with anticipated future conditions.

To see if training really was required, and what kind, an extensive study of superintendent and foremen jobs was conducted with the following objectives in mind:

1. Determine current problems;
2. Get a better inventory of the skills and knowledges of the incumbents; and
3. See what skills and knowledges newly appointed people to those positions should have.

The study included the following information-gathering activities:

1. Discussions with the individuals who perform regular staff reviews of the function;
2. Interviews with working, supervisory, and management levels to identify problem areas;
3. Detailed observation of maintenance people at work to see specifically what they do and what gives them problems;
4. Consultation with higher level supervisors and others who have contact with maintenance forces; and
5. Analysis of cost reports and budget submittals.

The information gathered was carefully reviewed by a task force of selected maintenance supervisors. The conclusion was that training was needed, both to meet future demands and because prior training of the superintendents and foremen had not covered several important aspects of the job.

The task force assigned priorities to the identified needs. We decided that 1 week of intensive training for all of the approximately 700 superintendents, landscape specialists, and foremen would make a significant contribution toward solving the problem.

The needs identified as most pressing were as follows:

1. Decision-making skills in handling both ordinary maintenance administration and disaster operations;
2. Skill in preparing annual budgets and in using cost reports as management tools;
3. Skills in estimating the cost of repairs;
4. Familiarity with new maintenance techniques and tools;
5. Public-contact skills, including those needed in relationships with other agencies;
6. Skills in coping with personnel problems in hiring, firing, disciplining, and motivating; and
7. Knowledge of landscape maintenance, because superintendents have recently acquired supervision of this expanding function.

These were required for the general foreman and superintendents. The needs of the landscape foreman group are slightly different and it was decided to have separate training for these supervisors.

HIGHWAY MAINTENANCE ACADEMY

The objective was to have the superintendents and foremen learn the application of skills to their jobs. It was therefore decided that the traditional lecture, short-course approach to this training would be inefficient. The methods that were adopted for the live-in highway maintenance academy are as follows:

1. Before attending the academy, the student completes a pre-academy, self-study course. This consists of 260 pages covering personnel, public relations, service and supply, budgets, estimating mathematics refresher, landscaping, outdoor advertising, and permits. The student retains this material for future use, but the primary goal is to give him the knowledge and background information necessary to gain full benefit from the academy work.

2. At the academy the superintendents and foremen practice the skills required in a setting as realistic as possible. They receive immediate feedback as to how well they do, then are given further opportunities to practice to improve their skills.

3. Because these methods work best in small groups, the 35 trainees are divided into 7 teams of 5 men each. Throughout the academy these teams compete against each other. Points are assigned for each problem completed and for how well it is solved. At the end of each day points for each team are displayed. Each team's total points are accumulated, and at the end the members of the winning team each receive a new hard hat with a "winning team" decal and a gold seal on their certificates of completion. This element of competition adds a great deal to the students' interest and motivation.

4. To give a framework in which this training could operate, an artificial transportation district was created on paper within the existing highway structure. Staffing charts, budgets, equipment lists, telephone books, maps, and other documents were prepared for use by the teams. All problems at the academy take place within one superintendent's territory in the mythical district.

5. During the instruction, a compressed version of the superintendent's work is simulated. Mail is delivered that requires replies. The telephone, manned on the other end by instructional staff, brings maintenance and personnel problems to the superintendent. Official visitors, again played by staff members, call at the superintendent's office. Thus, the trainees are required to sift and handle routine problems.

6. Closed-circuit TV is used as a training aid. A television camera is used to tape each team in action during various parts of the academy. Summaries of these tapes are played back for the teams to see and hear themselves and give their own evaluation of how well they did.

These methods are followed to a large degree throughout the academy. Because of this, the number of people who can be trained at any one academy session is quite limited. Teams of 5 seem to be a maximum, and 7 such teams is about all that can be satisfactorily handled at one time. These students are gathered from all 11 transportation districts. Each 5-man team has no more than 1 student from a given district.

Approximately 50 hours of classwork are covered during a highway maintenance academy. The cost of one academy, Monday through Friday, including board, lodging, and salaries for both students and instructors, is estimated at \$18,000. Some 735 highway superintendents, foremen, and potential foremen have been trained in the 21 maintenance academies held since 1966. Two maintenance academies a year are now adequate to meet current needs for this training.

At each academy, the full-time instructional staff is composed of 4 senior superintendents and 3 highway superintendents. In addition, 15 specialists from various fields serve as part-time instructors when the academy subject matter is concerned with their specialty areas.

Headquarters maintenance branch operates the academy, providing the instructional material and several of the part-time instructors. The full-time staff is borrowed from the districts for each academy on a rotating basis. This has several benefits, including adding fresh ideas and attitudes to the academy training.

Figure 1 shows the subjects covered in a highway maintenance academy session.

Figure 1. Highways maintenance academy schedule.**MONDAY**

- . Academy Briefing
- . Public Relations

TUESDAY

- . Personnel Processes
- . Personnel Panel - Open Discussion

WEDNESDAY

- . Human Relations
- . Maintenance Management System
- . Other Agency Relationships
- . Service and Supply
- . Elements of Letter Writing

THURSDAY

- . Safety
- . Tort Liability
- . Outdoor Advertising
- . Materials and Research
- . Equipment - Maintenance Relationships
- . Landscape Management
- . Comprehensive Examination
- . Examination Review

FRIDAY

- . Simulation
- . Awards

Figure 2. Highways landscape academy schedule.**MONDAY**

- . Academy Briefing
- . Nonchemical Means of Pest Control
- . Question and Answer Period
- . Equipment Discussion

TUESDAY

- . Personnel Case Problems
- . Personnel Case Problems Critique
- . Human Relations

WEDNESDAY

- . Maintenance Management System
- . Parasites and Predators
- . Safety

THURSDAY

- . Public Relations
- . Biological Control of Weed Pests
- . Service and Supply Presentation

FRIDAY

- . Landscape Architecture
- . Torts
- . Awards

HIGHWAY LANDSCAPE ACADEMY

The purpose and objectives of the landscape academy are the same as those outlined for the maintenance academy, with emphasis on the technical aspects, supervision, and administration of landscape work as performed in most districts throughout the state.

Seven landscape academies have been held since their beginning in 1967. Personnel who attend are landscape leadingmen, landscape foremen, highway tree foremen, and landscape specialists I.

Trainers are assigned from landscape specialist classes from both headquarters maintenance branch and the districts. Several other departments also furnish instruction during each session.

An objective of the Department of Transportation is to maintain both the landscape plantings and the natural growth on the roadsides as economically as possible with a minimum use of chemical pesticides. To implement the research work that has been accomplished and realize the benefits of this research, the training of the maintenance employees is accomplished by a series of illustrated lectures and demonstrations by the faculty of the University of California and by U.S. Department of Agriculture scientists.

As in the maintenance academy, there is a pre-reading unit consisting of 90 pages covering material on personnel, public relations, and technical landscape work.

Figure 2 shows the subject matter covered in a landscape academy.

There is no exact yardstick that can be used to measure educational courses of this type that will indicate direct benefits to the department or the individual. The feedback from ex-students, instructors, and district chiefs of maintenance indicates that considerable knowledge of administration, personnel problems, estimating, general policy, budgets, and cost reporting, to name a few, has been assimilated beneficially. Many of the students were made aware of the proper way to handle disciplinary actions for the first time.

In the past several years a number of "outsiders" have attended the academies, either as visitors or as students. They were from out-of-state, from another agency, or perhaps from another unit in the Department of Transportation. The feedback from these visitors has been very favorable.

Many students have commented that this training has introduced them to subjects and methods used elsewhere in the state that they had never heard of before. This is logical, since the course is tailored from material taken from practices employed in all 11 districts. Another important point is that the student recognizes his weaknesses in certain subjects and in many cases is motivated to overcome them.

The "vital shift"—the promotional advancement in a maintenance career from a worker to a manager, from a "doer" to a "delegator", from a field atmosphere to an office atmosphere, from a line boss directing one or two crews to a manager coordinating the efforts of many line supervisors—is being accomplished by the academy approach to training.

The gathering of a broad spectrum of employees in an academy atmosphere results in identification of additional training needs. As a consequence, we have three additional training programs under way, which are briefly described in the following.

MAINTENANCE MANAGEMENT SEMINARS

California, like many other states, is presently in the implementation stage of a maintenance management system. This system is composed of the major components present in all systems, such as quality standards (levels), inventory items, work standards, work programs, activity identification, and budgeting and reporting. Our management system is in its third year of implementation. The goal for full implementation is July 1, 1975.

No system will realize its full benefits unless it is used, and supervisors must be trained to utilize the tools a modern management system provides. This need is being met by creation of maintenance management system seminars. The seminars consist of 4-day sessions using the live-in academy training approach. All maintenance supervisors from the foreman level to the district chiefs of maintenance will have been trained in system use by the end of 1974.

Figure 3 shows the subject matter covered in these seminars.

MAINTENANCE BASIC SUPERVISION COURSE

The three previously described training programs do not adequately cover the very important area of human relations. Present-day first-line maintenance supervisors face many new employee-related problems that cannot be solved by the old-time "straw boss" approach. We are living in a more permissive age, and the foreman must consider this when dealing with his subordinates. Employee organizations are growing and are having greater voice in overall working conditions. Foremen must keep themselves informed and respond in an appropriate manner to problems in this area.

In the past, human relations training was provided by a generalized basic supervision course designed for all supervisors in the Department of Transportation. Since this course was not adequate in helping the maintenance foreman solve his employer-employee problems, a course has been developed that is tailored strictly to his needs.

The course is being given to groups of maintenance supervisory personnel in all 11 districts. Trainers are maintenance supervisors who have completed an instructors' training course.

Figure 4 shows the subject matter contained in this 40-hour course.

MAINTENANCE CORRESPONDENCE COURSES

Below the foreman level most training is accomplished by on-the-job training, with foremen passing their knowledge and skills on down the line. However, additional training needs were identified in basic fundamentals of both a technical and administrative nature. Maintenance correspondence courses were created in 1970 with the primary objective of reducing maintenance costs by increasing the employees' knowledge and proficiency of maintenance operations. In providing these courses it is planned to

1. Minimize the on-the-job training required for new personnel;
2. Update and refresh the basic maintenance knowledge of more experienced personnel; and
3. Provide maintenance knowledge in subjects not easily available to some personnel because of job assignments or location.

Home study courses for landscape employees are presently being prepared.

Figures 5 and 6 show the correspondence courses and indicate the wide range of subjects covered in the series. As a home study course, the time spent by the employee is his own. Some 2,700 of the maintenance employees in California are working on the correspondence courses at this time, and approximately 400 have completed the road maintenance courses to date.

There have been accumulated savings of approximately 1,500 man-years and \$23 million in the last 4 years attributable to our maintenance management system. We feel that a portion of this savings has been due to the instructions and training given at our academies and seminars.

California's maintenance training programs are very ambitious. We have always been of the opinion that the caliber and actions of our maintenance people are the best advertisement a highway organization has. This is especially so in the more remote areas or where the local foreman or superintendent is the Department of Transportation in the eyes of the people we serve.

DISCUSSION

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The paper by Wilson and Smith indicates that California recognized that a problem existed and systematically set out to devise a solution. This is certainly the most ambitious, sophisticated, and complete training program in operation that I have seen for maintenance personnel.

Figure 3. Maintenance management system seminar schedule.

MONDAY	WEDNESDAY
. Current Status of MMS	. Management & Cost Reporting
. Quiz	System (overview)
. Reporting Revisions	. Report Analysis
. Equipment Management	. Presentation of Analysis
. Quiz Critique	. Biological Control
	. Human Relations
TUESDAY	THURSDAY
. Reporting	. Quiz
. Inventory	. Letter Writing
. E.D.P. Processing	. General Discussion
. Annual Work Load Plan	
. Organization	

Figure 4. Maintenance basic supervision course subject matter.

- . Interpersonal Relationship
- . Public Relations
- . Relationships with Employee Organizations
- . Communications
- . Team Development
- . On-The-Job Training
- . Discipline and Punitive Action
- . Grievance Procedure
- . Interviewing Prospective Employees
- . Special Employment Programs
 1. Career Opportunity Development
 2. Employing the Underprivileged
- . Employee Motivation
- . Cultural Awareness

Figure 5. Maintenance correspondence courses available.

VOLUME 1

- . Aggregate Bases and Subbases
- . Asphalt Concrete and Liquid Asphalts
- . Blasting

VOLUME 2

- . Bridges
- . Concrete
- . Guardrail
- . Median Barrier and Right of Way Fence
- . Painting
- . Personnel
- . Pollution Control
- . Public Relations
- . Safety

VOLUME 3

- . Signs and Pavement Delineation
- . Snow Removal
- . Traveled Way, Shoulders, and Drainage Structures

SEPARATE VOLUMES

- . Practical Mathematics Review
- . Plan Reading

Figure 6. Landscape correspondence courses available.

VOLUME 1 (completed)

- . Botany

VOLUME 2 (being prepared)

- . Biological Control
- . Safety
 - Safety Attitudes
 - Safety Organization
 - Traffic Control
 - Eye Hazards
 - Highway Spills
 - Pesticide Safety
- . Watering Methods

VOLUME 3 (being prepared)

- . Turf Management
- . Tree Trimming
- . Shrub Pruning
- . Chemicals (pesticides)
- . Fertilizers

VOLUME 4 (being prepared)

- . Plant Pests and Diseases
- . Weeds
 - Identification
 - Methods of Control

California has controlled the training environment by establishing a maintenance training academy where personnel can be isolated from work-related distractions. The course is highly structured to contain those subjects that were considered to be the most vital to the organization. The inclusion of an expert staff and the element of competition seem to ensure the success of this effort.

After a discussion with representatives of the California Department of Transportation some 4 or 5 years ago, New York State Department of Transportation instituted a similar program for our maintenance engineering personnel. Without the benefit of a department facility, our effort to remove personnel from their work environment had to involve motels and available space at the main office for classrooms. A 3-day program for our highest level of foremen was instituted. This program was offered at locations throughout the state, but not at work locations. These programs have been well received by the participants.

My comments are addressed to maintenance training in general and do not apply specifically to the subject paper. Examination of the courses covered in all these programs indicates a trend in maintenance training that reflects the concern of management about maintenance. Courses offered are in administration, supervision, cost estimating, budgeting, and planning. No longer are subjects covered that relate directly to the physical acts of maintenance or maintenance technology. What needs repairing, how to repair it, and the correct use of equipment and materials are relegated to the background of the training effort, if indeed they are covered at all. Is this a trend that emphasizes form over substance, paper over product, and makes the data processing machine the master rather than the tool? Since the greatest savings that can be made in maintenance (outside of some miraculous material development) appear to be in the personnel area, perhaps the need for this direction in training is correct.

There is a question as to just how fast people with various levels of education can absorb training. Many of us have been involved in week-long live-in training sessions that saturate you with information from 8:00 a.m. to 10:00 p.m. We have also observed the tailgate safety sessions lasting 15 minutes. Which is the more effective in altering behavior or performance? Roy Jorgensen Associates, in the course of a contract for the development of a maintenance curriculum, has done extensive research into training of maintenance personnel. The results of this research seem to indicate that a 3-hour training session is the optimum length for the average foreman.

There is nothing more frustrating than knowing a better way to perform and not being able to use it because the hierarchy will not change to new methods. Training thus can only get results if the working environment is receptive to the ideas. It is therefore important that either the existing management be heavily involved in the direction of any training so that the training is compatible with organizational thinking, or, if a new technique, style, or system is to be introduced, that it be introduced, sold, and put into practice at the highest level first and then work its way to the first-line supervisor.

A proper experiment needs a "test section" and a "control section" so that new products or techniques can be compared with a "known". The benefits of training are difficult to quantify, and if we were to withhold funds for training until similar justification was available there would be little training. Nonetheless we should attempt to check if the courses and techniques used are achieving the results we want. Instead of involved attempts to measure dollars saved, we should at least be measuring knowledge gained. This means giving two comparable tests, one prior to training and one after. It is understood that the Jorgensen firm used this technique to prove out its curriculum.

Another problem with training is that it can become too far removed from the operation. When this occurs, we can measure an increase in knowledge as a result of the training but no application of such knowledge to the job. The training then becomes a way to pass exams or a line on the resume, but it has no real bearing on the real world to the man trained. We pay for 8 hours' work and perhaps we could expect that crews will travel for 1 hour and have other nonproductive work such as coffee breaks, setting up time, and personal time to amount to another hour, so that we anticipate 6 hours of working time. If we alert supervisors to the need to achieve this effort and through training in scheduling, supervision, and motivation demonstrate how to achieve it, and then still find we get less than 5 hours' performance, then our efforts have been stopped

short of the goal. There is some element that cannot be trained into a supervisor and that is an acknowledgment of his responsibility to see that the owner (or in our case the taxpayer) gets value in return for value given.

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Historically, the first-line supervisor has been the most neglected segment of our industry. In recent years many have recognized this as a costly and critical oversight and are attempting to correct or improve the condition in a variety of ways. Formal training programs are gaining acceptance, and much work is being done in the area of development.

The basic maintenance supervisor course described in this paper was of great interest to me. The authors made reference to the "vital shift", or the advancement of a doer to a delegator. Foremen for the most part are promoted from the ranks with little or no supervisory skill and generally with little or no concept of the job requirements. The problem of changing basic attitudes of line personnel—men who before promotion relied on the boss for their daily assignments, were union members, and were pals and buddies with their fellow workers—is generally a difficult one. This is a drastic turnabout for the average employee. Now, he is expected to think differently, be dollar- and time-conscious, get a day's work from those previous fellow workers, handle union grievances, administer discipline, make decisions, and be accountable for results. Unless we provide the proper training and guidance, all we can or should expect is another high-priced liaison man or runner.

AUTHORS' CLOSURE

It was noted that, in general, maintenance training is pointed toward administration, supervision, cost estimating, budgeting, and planning and away from subjects that relate directly to the physical acts of maintenance or maintenance technology. This is true of our academy-type training in maintenance and landscape and, to a degree, reflects management's concern in these areas. However, we have developed correspondence courses that cover a wide range of basic knowledge, with direct application to maintaining the roadway and landscaping.

Between the academies, the correspondence courses, the maintenance basic supervision course, and other training available at the district level, we feel that most areas of employee and management needs are being met. The academies and other training approaches are revised or developed as needed to better meet the changing times.

The academy type of training has worked well for us, both for freedom from work-related distractions and for the benefits of bringing together in a central place people from all over the state for a free exchange of ideas. Also, our district maintenance engineers, senior maintenance superintendents, maintenance superintendents, and landscape specialists instruct at the academies and seminars on a rotating basis. This has benefits for both instructors and students.

I agree that further studies are needed to determine the most efficient and effective types of training.