7.A. OVERVIEW

Maintenance is one of the biggest challenges facing the County Engineer. It is also the greatest opportunity for success. Used proactively, the maintenance crews are a wealth of information. No one else drives the roads daily and fixes all of the recurring problems. They can be the eyes and ears of the Road Department and even provide a pulse reading of community attitudes and growth problems which otherwise may be overlooked until the Commissioners are involved. They have as much or more contact with the public as any other county organization and represent the county both positively and negatively. The daily and weekly maintenance results on the roads are one of the most visible services provided by the county. They can make the Engineer's job easier, or they can make it impossible.

The maintenance program is usually one of the largest groups of employees in the county and one of the most unionized. The differences in educational background between the typical engineering employee and the typical maintenance employee often lead to a lack of communication and potential mistrust and can lead to conflicts within the department.

The maintenance budget is typically 1/3 to 1/2 of the annual expenditures of the road department. The budget is substantial and the standards and practices vary widely among counties.

7.B. MAINTENANCE ACTIVITIES AND TECHNIQUES

Maintenance can be roughly categorized into three groups: reactive, routine, and preventive maintenance.

Reactive maintenance includes unanticipated failures of road surfaces, loss of signs, trees across the road, etc. It also includes response and repair during true emergency conditions such as flooding, windstorms, earthquakes, and volcanoes. Historically, most counties can anticipate events and can roughly budget for them. Emergencies can provide a severe test of the engineer and the road department. The department must have practiced plans in place and the commissioners must provide a budget item for the unexpected. If the department flounders in its response through lack of preparation, lack of obtaining appropriate permits, inability to make responsible, on-the-spot decisions, lack of control over employees, or even the perception of incompetence, then the engineer may have lost the confidence of the Commissioners.

Routine maintenance is the normal day-to-day budgeted activities that keep the roads operational. The key to successful routine maintenance is an annual work plan that is balanced between FTEs and budget and has the necessary supplies, materials, and equipment available with qualified operators at the scheduled time and location. Key to a successful work plan is knowing the cost of the various unit activities that are performed. This cost includes man-hours of various skills, equipment hours, and materials. The accuracy to which these costs are tracked and updated is critical.

Preventive maintenance is planned effort to restore an item to good condition while the restoration is cost effective and well before routine maintenance is required. The pavement management strategies are examples of preventive maintenance.

There are several peer groups representing maintenance interests. The "Weed Whackers" meet several times per year and share information. The Northwest Pavement

Management Association provides excellent information. There is also a group of city/county/state fleet managers.

7.C. MAINTENANCE MANAGEMENT

Maintenance Management is based on the application of sound management principles to public works maintenance operations. A Maintenance Management System (MMS) provides for the orderly conduct of the following essential management functions:

- Planning and budgeting
- Organizing to do the work
- Directing the work
- Controlling the results

Maintenance Management Systems have been designed to incorporate these essential management functions into maintenance operations. A typical MMS consists of the following elements:

• Setting objectives	}	Planning & Budgeting
• Defining work activities and standards	}	Planning & Budgeting
• Developing annual work programs	}	Planning & Budgeting
• Organizing and allocating resources	--	Organizing
• Authorizing and scheduling work	--	Directing
• Reporting and evaluating performance	--	Controlling

The first three elements are related to the management principle of <u>planning and budgeting</u>, the fourth element is related to <u>organizing</u>, the fifth is related to <u>directing</u>, and the last element is related to <u>controlling</u>. The results of the reporting and evaluation function are used not only to control the work, but also to feed back to the planning function to improve the accuracy of the next work program and budget.

A schematic representation of a Maintenance Management System is shown on Figure 7-1. Further description of MMS elements is provided below.

7.C.1 OBJECTIVES

The primary purpose of a Management System is to carry out objectives in the most effective and efficient manner possible. This requires setting of objectives to guide management efforts and to serve as the basis for developing plans, measuring progress, and evaluating results.

A public works maintenance organization is concerned with preserving the public investment in facilities, providing adequate levels of service to ensure safe and efficient operation, and making efficient use of available resources. These are very basic and very general objectives. The Public Works Manager must set more specific objectives to guide day-to-day maintenance operations.

An operating policy for maintenance management should be developed and officially adopted. In carrying out this policy, levels of service and standards of performance will have to be established for the various maintenance activities, and both work programs and budgets will have to be defined to achieve these

levels. Furthermore, there must be a commitment to provide the required resources to carry out the maintenance work program. This, in turn, means that priorities will have to be established for the entire public works operation to avoid conflicts between construction, maintenance, and other activities of the agency.

7.C.2 WORK ACTIVITIES AND STANDARDS

The first step in developing a maintenance work program is to define the work to be done. The work must be identified in unmistakable terms that are measurable and that can be related to resource requirements on a consistent basis.

Specific work activities are identified by name and number to account for most of the annual workload – typically 85 to 90 percent. The remaining 10 to 15 percent of the workload is usually composed of an almost endless list of rather minor activities that can be grouped as "miscellaneous".

A quantity standard is used to define a level of service for a specific activity. That is, the quantity standard is used to define the amount of work that needs to be done to provide the desired level of service. These are established largely on the basis of experience. For example, the Maintenance Manager may know from experience that approximately 0.25 tons of premix per lane-mile has to be used on the roads each year to keep up with pothole patching. That value, then, can be used as a quantity standard and may be adjusted upward or downward to raise or lower the level of service for pothole patching.

Performance standards are used to define the best way to accomplish each activity. The optimum crew and equipment complement is specified, along with the major materials needed and the preferred procedure for doing the work. Also, the expected amount of work to be accomplished each day is specified, based on using the standard over a period of time under average conditions.

7.C.3 DEVELOPING WORK PROGRAMS AND BUDGETS

Another prerequisite to preparing a work program and budget is obtaining an inventory of all facilities to be maintained.

Unit costs will be needed for labor, equipment, and materials so that the cost of performing the work can be determined. The unit costs can then be applied to the standard list of resources for each performance standard to determine the average daily cost for performing each activity.

With the inventory, quantity standards, performance standards, and unit costs in hand, the annual work program and performance budget may be determined.

By applying the quantity standards to the inventory values, the annual workloads by activity are determined. Applying the performance standards to the workload provides the amount of labor, equipment, and materials required to accomplish the work.

The performance budget is calculated by applying the unit costs to the resources and totaling the results. The term "performance budget" is used because the

budget is derived from a specific amount of work that is to be performed rather than by the traditional method of making an adjustment to last year's budget to reflect inflation and other factors.

7.C.4 ORGANIZING AND ALLOCATING RESOURCES

To accomplish the work program efficiently, the workload must be evenly distributed throughout the year. Seasonal influences on the work must be taken into account first. Then, the remainder of the workload must be distributed to achieve as level a workload as possible.

With the workload spread out over the year on a monthly basis, an annual work calendar can be developed to guide the development of short-term schedules. Specific requirements for labor, equipment, and materials on a monthly basis will be known well in advance so that no shortages should occur when the work is ready to be done.

Some agencies budget by sub-areas within their jurisdiction, or by road classes, or by some other criterion. The same programming and budgeting process may be used to develop sub-unit work programs and budgets that may be combined to obtain the agency-wide work program and budget. With resource requirements for each sub-unit clearly defined, the allocation of appropriate resources to each unit in order to accomplish its assigned workload will be a straightforward matter.

7.C.5 AUTHORIZING AND SCHEDULING WORK

The secret to providing the desired level of service and staying within budget is to ensure that only the planned amount of work is done – no more and no less. After the annual work program and budget is approved, managers must have a simple method of authorizing and scheduling work to ensure that the work program is carried out as planned.

Usually bi-weekly schedules are prepared, using the annual work calendar as a guide. To the extent possible, the planned work should be carried out and every effort should be made to stay on schedule. If activities such as snow removal or storm damage repairs and cleanup turn out to be greater than planned, the work program will have to be adjusted or additional funds requested to complete the planned work.

To ensure that field crews perform only the authorized work, work-orders or crew-day cards are typically used by the supervisor to authorize work on a day-to-day basis. Each work order authorizes a crew to perform a specific amount of work on a specific activity.

7.C.6 REPORTING AND EVALUATING PERFORMANCE

Daily time cards are typically used in Public Works organizations to track labor, equipment, and materials used for maintenance activities. These cards or forms, if properly designed, can also be used to report the amount of work done and the locations of work as well as the resources

used. Normally, these are completed at the end of each day, or at the end of each job if more than one activity is performed during the day.

The daily work reports should be reviewed by the supervisors promptly to ensure that they were completed properly and to determine if the performance standards were substantially followed. Significant variations should be followed up promptly to determine the cause and, if necessary, take corrective action.

The daily work reports are summarized on a monthly basis to produce performance evaluation reports. These are used to evaluate performance and monitor progress toward accomplishing the work program. Again, significant deviations from the planned work program and budget should be investigated and appropriate follow-up action taken.

The importance of this step cannot be overemphasized. Without evaluation and control to ensure that the plan is followed, the entire maintenance management effort will be in vain.

7.C.7 SUMMARY OF MAINTENANCE MANAGEMENT

The MMS is a complete management system and can provide more than management information alone. There are provisions for setting objectives and standards to aid in planning the work, for determining resource requirements, for developing the performance budget, and for scheduling, reporting, and controlling the work. Basically, the MMS is a process for more effective and efficient planning, organizing, directing, and controlling of maintenance work. It begins with setting specific, quantitative work objectives and then follows through the complete management cycle to ensure that actual performance is consistent with objectives.

7.D. TRAFFIC OPERATIONS

The aspect of maintenance and operations dealing with the placement and maintenance of signs, striping, and buttons is often either directly under the traffic engineer or at least is a separate section of the maintenance function because of the extreme liability concerns. This section can work closely with accident investigation and documentation.

MAINTENANCE MANAGEMENT SYSTEM

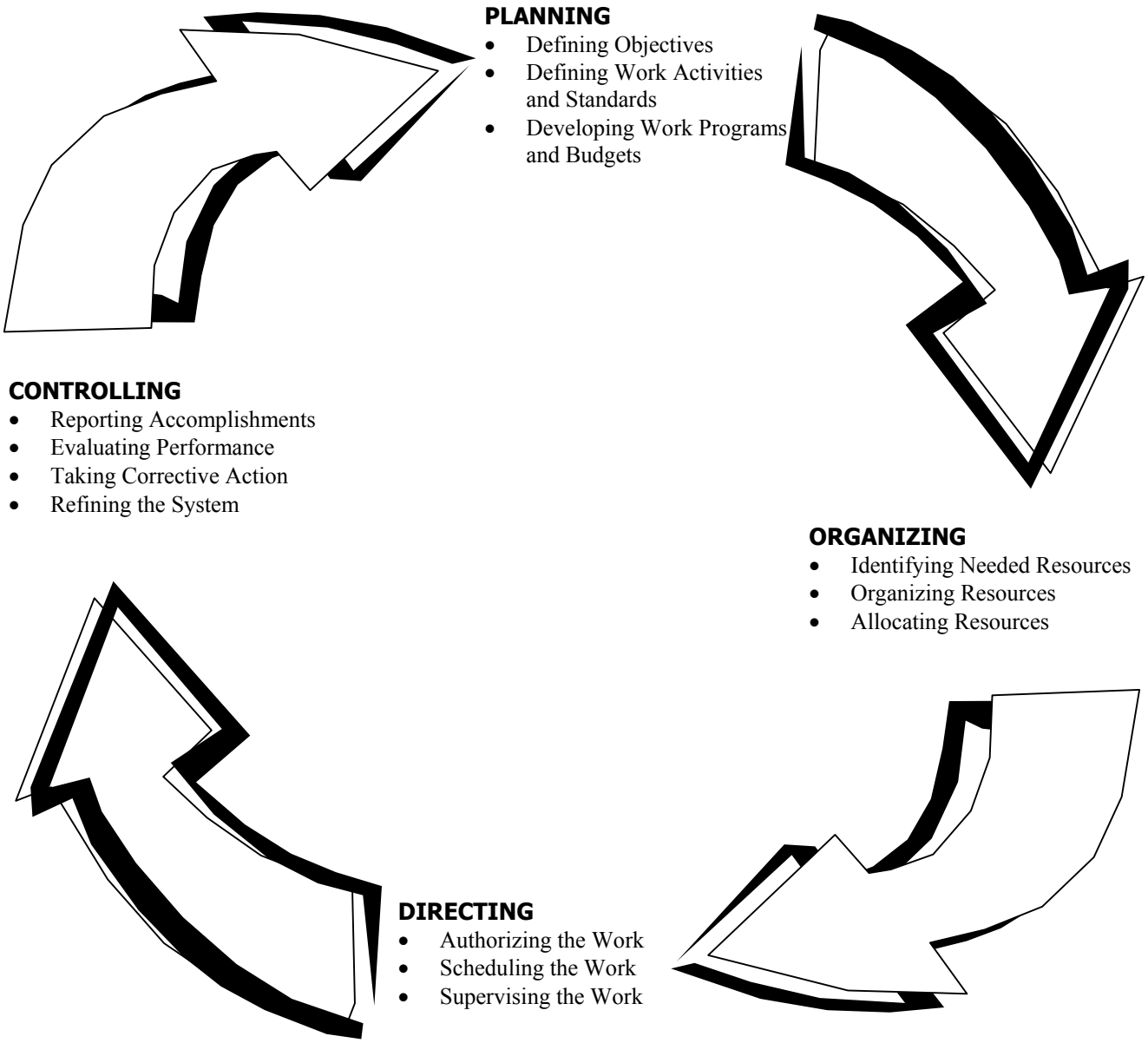

FIGURE 7-1