MAINTENANCE MANAGEMENT PROJECT
INITIAL SURVEY REPORT

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MAINTENANCE MANAGEMENT PROJECT REPORT

EXECUTIVE SUMMARY

Introduction

Based upon recent proposals, counties are being asked to demonstrate the effectiveness of their maintenance programs. Use of a Maintenance Management System is a way for counties to document characteristics of their maintenance programs and to communicate maintenance program effectiveness to the public, employees and other agencies.

In order to understand how the various elements of a formal maintenance management system (MMS) relate to existing procedures now being used in the counties, a survey of maintenance management was conducted. This survey is discussed below.

Survey of Maintenance Management

A brief survey form was sent to counties and used as the basis for further discussions concerning the use of maintenance management. The intent was to gather information on the county's use of a MMS by comparing elements of a formal maintenance management system with practices currently being undertaken at the county.

A Maintenance Management System (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.

By comparing the elements of a maintenance management system as outlined above with current practices in the counties, we are able to provide counties with some feedback related to how current maintenance practices compare to a formal maintenance management system.

The results of the survey indicated that a wide range of maintenance practices are in use throughout the state. Every county practices some form of maintenance management; however, the level of formality and the availability of information related to maintenance operations vary widely. The results are presented below:

PLEASE NOTE…..the brief survey was intended to elicit information concerning current maintenance practices in the counties and should not be construed as a complete or in-depth assessment of such practices in these counties. There are many variations and nuances contained in each sub-element of a formal MMS and as practiced in a specific county. Such nuances and variations are addressed in the "Discussion of Survey Results" section in the body of the report.

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Defined maintenance objective	15	24
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Performance standards prepared	12	27
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Conclusions and Recommendations

The results of the survey of maintenance management in the counties indicated that the details of management practice vary greatly. Such variations result in varying levels of maintenance program documentation and reporting. Use of a formal maintenance management system (MMS) can provide more consistent documentation and reporting of maintenance activities and is recommended. During the upcoming phase of CRAB's Maintenance Management Project, the following areas will be addressed:

1. Work with counties to provide the elements of a formal maintenance management system…. planning, organizing, directing and controlling.
2. Address reporting and data entry and the interface with the accounting system.
3. Describe the features of a formal maintenance management system and discuss with counties. Note—an overview of maintenance management is presented in the recently updated "County Engineers and Public Works Directors Manual" prepared by CRAB.

End of Summary Section

MAINTENANCE MANAGEMENT PROJECT REPORT

Survey of Maintenance Management Use in the Counties

Introduction

A primary element of the County Road Administration Board's mission is to preserve transportation infrastructure of Washington Counties by providing standards of good practice and professional technical services. Due to increased attention on the need for maintenance and preservation of transportation infrastructure—through recommendations from the Blue Ribbon Commission on Transportation, the requirements of the Government Accounting Standards Board Rule 34 and from various Washington State legislative proposals—counties are being asked to demonstrate the effectiveness of their maintenance programs. Use of a Maintenance Management System is a way for counties to document characteristics of their maintenance programs and to communicate maintenance program effectiveness to the public, employees and other agencies.

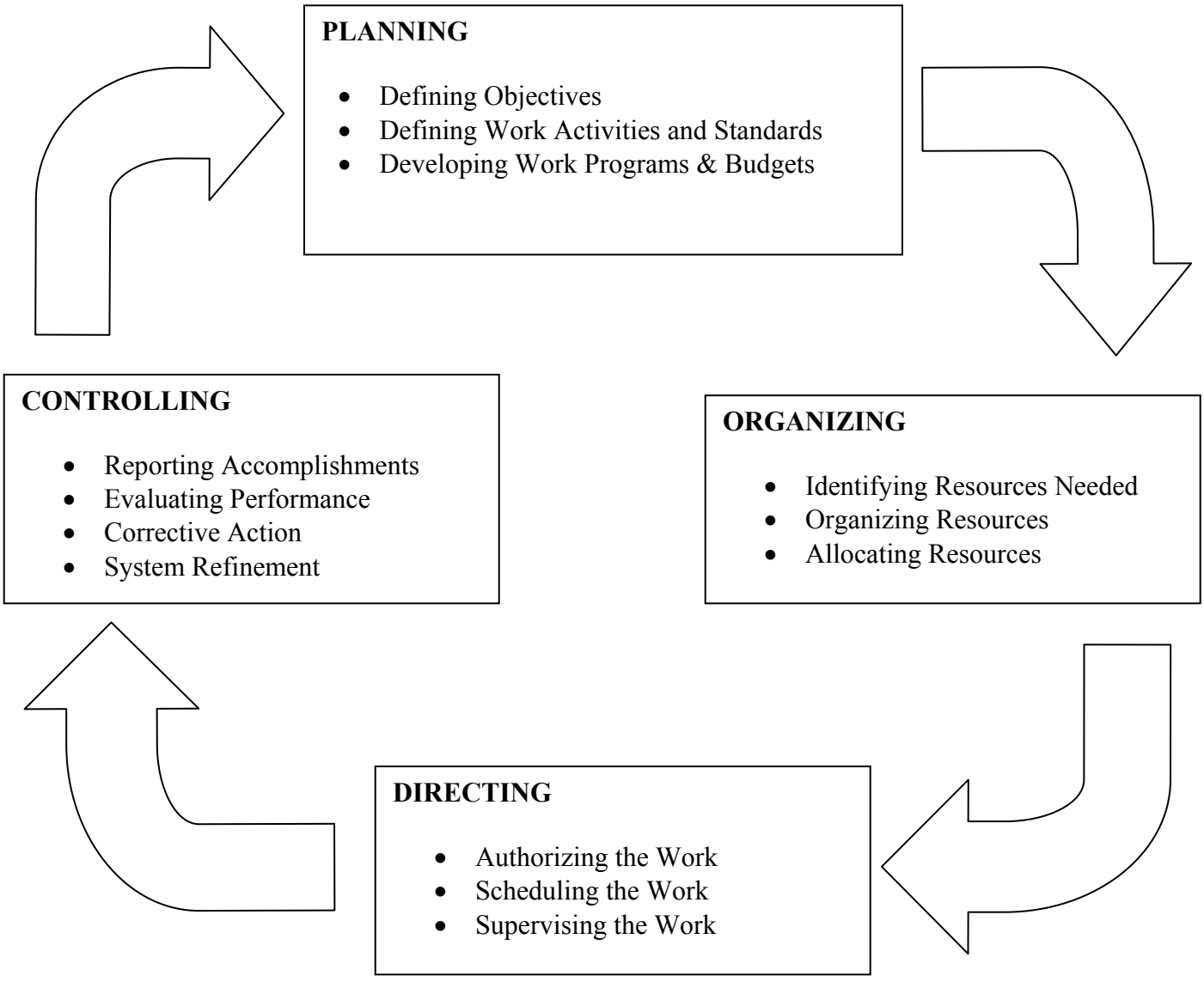
Because all counties practice some form of maintenance management, an initial part of CRAB's efforts to develop a suitable tool for the counties will need to be based on what is now being done in the counties. In order to understand how the various elements of a formal maintenance management system (MMS) relate to existing procedures now being used in the counties, a survey of maintenance management was conducted. This survey is discussed below.

Survey of Maintenance Management

A brief survey form was sent to counties and used as the basis for further discussions concerning the use of maintenance management. The intent was to gather information on the county's use of a MMS by comparing elements of a formal maintenance management system with practices currently being undertaken at the county.

A Maintenance Management System (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. The various elements and sub-elements of a formal maintenance management system (MMS) are presented in the schematic below.

MAINTENANCE MANAGEMENT SYSTEM SCHEMATIC



By comparing the elements of a maintenance management system as outlined above with current practices in the counties, we are able to provide counties with some feedback related to how current maintenance practices compare to a formal maintenance management system.

The survey:

Elements of a formal MMS	Use of MMS in _____ County
A. Planning and Budgeting	
1. Defined maintenance objective	
2. Defined work activities	
3. Maint. activities identified by BARS no.	
4. Performance standards for activities	
5. Inventory of facilities to be maintained	
6. Unit costs for labor, equip. & materials	
7. Budget for maintenance activities	
8. Work program related to budget	
B. Organizing and Allocating	
1. Resources needed for maintenance	
2. Seasonal and annual workloads	
3. Allocation of resources for workload	
C. Directing and Scheduling	
1. Authorization to schedule work	
2. Procedures for scheduling work	
3. Weekly or bi-weekly schedules	
D. Controlling and Evaluating	
1. Reporting of work—how much & where	
2. Reporting of resources used for work	
3. Evaluation of actual and planned work	
4. Reports showing budget status	
5. Reports showing work program status	
6. Evaluation of performance standards	

Results

The results of the survey, together with follow-up discussions with the counties to discuss how maintenance management is currently being used, provided the following responses. From these initial discussions, it was found that a wide range of maintenance practices are in use throughout the state. Every county practices some form of maintenance management; however, the level of formality and the availability of information related to maintenance operations vary widely. The results are presented below: As can be seen, we have compiled responses from 37 of the 39 counties. Follow-ups with the final two counties have been scheduled and are expected to be completed by the end of October.

PLEASE NOTE…..the brief survey was intended to elicit information concerning current maintenance practices in the counties and should not be construed as a complete or in-depth assessment of such practices in these counties. There are many variations and nuances contained in each sub-element of a formal MMS and as practiced in a specific county. Such nuances and variations are addressed in the "Discussion of Survey Results" section below.

	YES	NO
Planning and Budgeting		
Defined maintenance objective	15	24
Defined work activities	17	22
Activities identified by BARS no.	35	4
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Discussion of Survey Results

As indicated above, the survey was intended to provide a brief look at how counties practice maintenance management. The responses, however, can be interpreted in a number of ways and many of these responses would have notes to indicate more precisely how the maintenance management system sub-element is being used at the county. As an indication of the range of responses and the limitations of using such a brief survey as the one above, the following comments have been prepared.

Planning and Budgeting

Defined maintenance objective	The maintenance objective may be formalized through a policy statement adopted by the County Board of Commissioners, written into a manual or not written.

Defined work activities	Maintenance activities may be defined in a sentence or two or written as a formal activity guideline indicating why, when, where, how, and how much is done.
Activities identified by BARS no.	Activities may be identified by BARS number or maintenance could be identified under the 542 general maintenance identifier.
Performance standards prepared	The level of detail on the standard could include some or all of the detail necessary to form the basis for a work program and budget.
Inventory of facilities or features	There may be a separate inventory for maintenance management purposes and one for county road log data.
Unit costs for labor/equip/materials	Typically, all counties have such data as it is the basis for preparation of accounting reports. Such data, however, may not be used to generate unit costs for the various maintenance activities.
Budget for maintenance activities	This budget could be prepared for each maintenance activity or for all activities rolled up to the 542 BARS number.
Work program related to budget	A "work program" could be interpreted as a budget related to the maintenance program or specific maintenance activities or could be interpreted as a budget based upon a certain amount of planned work accomplishment for each activity.

Organizing and Allocating

Resources needed for maintenance	There exists a wide range of variation in how such resources are identified and allocated to maintenance activities.
Seasonal and annual workloads	Balancing of the maintenance workload throughout the year may be formal (using schedules and workload diagrams) or informal.
Resource allocation for workload	Resources may be identified for the entire maintenance workload or by specific maintenance activity.

Directing and Scheduling

Authorization to schedule work	May be formal of informal.
Procedures for scheduling work	Procedures may be formalized and utilize scheduling forms or be accomplished through regular weekly or daily meetings.
Weekly or bi-weekly schedules	The use of specific procedures and forms as opposed to relatively informal meetings seems to be split about equally.

Controlling and Evaluating

Work reporting--quantity, location	Work reporting is done at all counties. The level of detail, however, varies. Approximately one-third of the counties currently track maintenance cost, accomplishment and location.

	Note…a formal MMS, and one that provides maintenance cost accounting, utilizes the reporting of accomplishment in terms of work units.
Reporting resources used for work	All counties have some sort of method for reporting, though some include details of resource type and specific activity.
Evaluating actual and planned work	Evaluations may be accomplished through staff meetings on an informal basis or through scheduled meetings and the use of maintenance performance and budget reports.
Reports showing budget status	Such reports are produced with varying levels of detail, from budget status by activity (with breakdowns of labor, equipment and materials used) to maintenance program budget overviews showing budget used for the entire maintenance program.
Reports of work program status	A formal work program status report would show the status of the actual versus planned work by specific maintenance activity, together with work accomplishment and performance measures. This can also done on an informal basis through observations by maintenance supervisors.
Evaluation of performance standards	Is accomplished in a formal and in an informal manner and can be based upon detailed cost and performance reports or through observation.

Conclusions and Recommendations

1. Work with counties to provide the elements of a formal maintenance management system…. planning, organizing, directing and controlling.
2. Address reporting and data entry and the interface with the accounting system.
3. Describe the features of a formal maintenance management system (MMS). These features include 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. Presented below is an outline of a formal MMS. This is the Maintenance Management section included in the latest "County Engineer and Public Works Directors Manual" prepared by CRAB.

FEATURES OF A FORMAL MAINTENANCE MANAGEMENT SYSTEM

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 work programs and budgets to achieve these levels will have to be defined. 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.

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.

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.

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 which 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.

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.

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 over emphasized. Without evaluation and control to ensure that the plan is followed, the entire maintenance management effort will be in vain.

SUMMARY OF MAINTENANCE MANAGEMENT

A Maintenance Management System (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.

WHAT'S THIS DO FOR MY COUNTY? SUMMARY OF BENEFITS

The implementation of a MMS has resulted in benefits for both the maintenance organization and taxpayers. For the maintenance organization, the benefits can be both direct and indirect.

The **direct benefit**, which is the easiest to measure, is "savings". Of course it is necessary to understand what "savings" really means. In nearly all cases "savings" does not mean putting money back into the coffers. Rather, it means getting more work done. Few agencies have the luxury of having too much money. Thus, any savings realized from an MMS are put to use providing more or better service to the public.

Savings can be achieved in a number of ways. The most common measures of savings are:

- Crew productivity,
- Improved work methods,
- Increased service levels,
- Catching up on deferred maintenance, and
- Initiating new work programs.

There are other types of savings. With a computerized MMS, some agencies have been able to reduce paperwork. One area of savings that is not as easy to measure is in organization. With a better definition of the type of resources needed and when they are needed, the right mix of skills can be provided at the right time. For instance, by identifying peak demand the right amount of seasonal or temporary help can be brought on board at the right time thus reducing the need to maintain a large full-time staff.

Indirect benefits are not as easy to measure but maintenance organizations typically cite:

- **Better employee morale** due to a greater sense of awareness and importance for middle-level managers and supervisors, and
- **Improved cooperation among the various management units** (i.e., between the roads/streets maintenance units and the equipment management unit).

The MMS will also **benefit taxpayers** either by reducing expenditures for maintenance operations without reducing the levels of service, or by raising the levels of service without having to increase the maintenance budget. These benefits are made possible by increased efficiencies and better management. Another benefit derived from implementing the system is improved understanding between the taxpayers and the maintenance officials. By relating the maintenance budget to the work program and the corresponding levels of service, both sides can communicate using the same basis.

WHAT'S MY PART IN ALL OF THIS? THE ROLES OF COUNTY AUTHORITIES & PUBLIC WORKS OFFICIALS

In order to develop and implement an effective MMS, officials in government and the maintenance organization have a definite role to play. In the smaller agencies, the same person may fill several of these positions.

County Commission

As the representatives elected by the taxpayers, the Council/Commission must be sure that there is the full commitment of backing and resources for development and implementation.

Director of Public Works/County Engineer

This individual usually supervises operations and maintenance in several functional areas. With respect to the MMS, the Director of Public Works/County Engineer would appoint a Project Manager, if necessary, for development and implementations of the system and supervise the utilization of the time and money commitments authorized by the Council/Commission.

The Director/Engineer must become well acquainted with the elements and procedures of the MMS, especially the evaluation of the previous year's results, and the planning and recommendations associated with the coming year's maintenance program and budget.

Maintenance Manager

Regardless of the size of local government, there is one individual who is directly responsible for road and street maintenance. In small agencies, a separate position may not exist, but someone is responsible for road and street maintenance. This key individual will become the manager most familiar with all the elements and procedures of the system.

Whereas higher-level individuals may be involved with major decisions involving the annual maintenance program, the Maintenance Manager will routinely be involved in decisions involving assignment of resources, emergency work and changes in program priorities.

The temporary assignment of a Project Manager to be directly responsible or to assist the Maintenance Manager in the system planning, development and implementation should be considered in the commitment by higher officials.

During the course of developing the MMS, the Maintenance Manager will no doubt want to acquire some of the references to become more familiar with various elements of the system.

Maintenance Supervisors and Foremen

Maintenance supervisors and foremen will play important roles in developing and implementing the system. Their knowledge of day-to-day operations, efficient work methods and skills of the

labor force will be essential in setting up performance standards and advising management on training needs.

The system will provide the framework to guide them as they prepare the periodic work schedules. In addition, the system will provide guidance so that the supervisors and foremen will be better able to make adjustments in the work schedules and to better control production and productivity.

One of the principal benefits of the system is that, generally, morale improves as the supervisors and foremen become more involved in managing their operations.

Equipment Manager

The Equipment Manager plays a key role in any organization as the one who provides and maintains the fleet for use by the operations forces.

The MMS allows the Maintenance Manager to provide a more logical forecast of equipment needs and utilization requirements and allows the Equipment Manager to do a better job of managing the fleet to meet these requirements. Since each manager has definite objectives and schedules, there will be better communication and cooperation between the maintenance and equipment organization.

WHAT'S THIS GOING TO TAKE TO GET STARTED? CONSIDERATIONS IN PLANNING FOR DEVELOPMENT AND IMPLEMENTATION OF THE MMS

The basic concepts and procedures associated with the MMS have been field-tested and proven effective in a large number of agencies – large and small. However, there are a number of considerations and pitfalls that will influence the success of the system implementation. The survey of MMS shows there is already some use of MMS principles in the counties so efforts to enhance and improve use of MMS are on solid ground.

Commitment and Support by Government Officials

Some changes will need to be made in the way that work is planned, scheduled, performed, reported, and controlled. Training will be required. Depending on staff availability and capability, outside assistance may be required. The governing body must be informed of the objectives, operational characteristics, benefits, and cost of the undertaking and they must be committed to providing the required support. Without the understanding and support of the governing body, the project is not likely to get underway.

Sound Planning and Scheduling

Any undertaking of this magnitude requires careful planning and scheduling. A plan and schedule for system development and implementation must be developed and resource

requirements estimated. Staff responsibilities should be clearly assigned, including appointment of a project / maintenance manager to supervise and coordinate the entire effort.

Over-refinement and Excessive Development Efforts

There is a danger in trying to design the "ultimate" system that may never be completed. Attempts to define excessive numbers of activities to cover every conceivable work item, or to perform time and motion studies to establish performance standards, or to develop complex reporting procedures are generally unnecessary and should be avoided.

The Human Element

Resistance to change is an understandable, but often unwarranted, human reaction. Employees at all levels will be concerned about the impact of the new system on them personally and on their organizational unit. Union officials may be concerned about the impact on job security and compensation.

The best way to overcome resistance to change is to keep employees informed of the objectives and benefits of the MMS and to involve them to the extent possible during system development. Input from the more experienced employees, especially foremen and crew leaders, will be most valuable during development of standards and optimal work methods.

Reducing Paperwork

To the extent possible, the reporting documents used to supply the MMS information should be used to fulfill other reporting requirements, such as payroll, equipment usage, etc.

Reducing the number of input documents will generally save time and avoid duplication of effort. However, if other reporting requirements are of such complexity that implementation of the MMS will be unduly delayed or compromised, and then development of the MMS should proceed independently. The benefits to be gained from improving maintenance management will most likely far exceed the benefits to be derived from reducing paperwork elsewhere in the organization.

Automation

An MMS can be implemented in a manual mode. The benefits of an automated MMS are to provide managers with a tool, for more effective management, and to provide timely and accurate information upon which sound decisions can be made. The larger agencies, at least, will receive additional benefit from an automated system due to faster "turn-around", e.g., faster analysis of work program alternatives, faster budget calculations, faster receipt of management reports after each reporting period, etc.

Automation will require suitable hardware and acquisition or development of software and specialized training for effective use of the automated system.

Even if the MMS is to be automated, it will be beneficial to perform the first few weeks of calculations manually. This will ensure familiarity with the operation of the system and provide initial verification and increase confidence in (and appreciation for) the automated system.

As indicated above, an MMS, automated or manual, is not a quick fix, cure-all remedy to maintenance problems. It is a tool that, if properly designed, installed, and used, will help managers to make more-informed and more-timely decisions. Ultimately, use of the system should lead to a more cost-effective maintenance operation.

SUMMARY

The intent of the maintenance management project is not to tell counties how to perform their maintenance activities, but rather, to increase the application of formal MMS use in county maintenance operations. The use of a formalized MMS can provide county staff with the tools to examine their operations and look for ways to improve on the various operations currently being performed. Some counties currently have the ability to track unit costs of maintenance activities and the location at which work is done and are also working to update their activity guides (detailed descriptions of maintenance work activities) that are an important element of any MMS. Other counties are now working with a consultant to develop and implement a MMS.

CRAB is also working to develop the Mobility software to include a specific (MMS) tool for county use in managing maintenance operations. One of the challenges being faced by counties is the increased focus on system integration, specifically the integration of Public Works information systems with county accounting systems. As Larry and Walt continue their visits to the counties, this important issue will be discussed further.

There are many examples of good maintenance management practices being used at the counties and we hope to use such examples in promoting the application of improved maintenance management practices in all counties. The cornerstone of any successful MMS tool is set on a firm foundation of commitment to the process by the legislative authority, public works officials and maintenance personnel.