Analysis and Report on the 1968 Maintenance Management Workshop

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At the Annual Meeting of the Highway Research Board in 1967, it was decided that the Department of Maintenance would sponsor a maintenance management workshop. The agenda and operating details of the workshop were worked out at the 1967 midyear meeting of the department in San Francisco.

The purpose of the workshop was generally informative in nature. It was decided that invitations to all state highway departments would be made and that at least two individuals from each state would be requested to be in attendance. Other interested parties could participate as full working members.

The Highway Research Board in general and the members of the Department of Maintenance in particular were of the opinion that the particular research projects having to do with systematizing maintenance operations, that were being supported in some states, would be of interest to maintenance managers in general. There was a general feeling that state legislators were beginning to question whether or not the considerable funds, being approved for highway maintenance operations, were really necessary or were being spent wisely. The purpose of most of the research projects is to design a system to optimize the use of these funds. The maintenance workshop was to inform all participants of the work that was being done in the particular states that supported such research.

The Ohio State University was chosen as the site for the three-day seminar which was held from July 22-24 of 1968. There were 134 participants representing all but eight states and representing all but two provinces in Canada. The format of the seminar included a day and a half of talks by speakers who were familiar with the latest technology which has been developed for these maintenance research projects.

On the morning of July 22 after initial welcoming speeches, William N. Records, Highway Research Engineer, Bureau of Public Roads, spoke on "An Overview of the Highway Maintenance Management Research Program in the United States." He reviewed maintenance management during the past fifty years and particularly emphasized the studies that had been done in the recent past. Studies included the 1959 Ohio State study, the Louisiana study of the early 1960's, the Oklahoma Department of Highways study, the Illinois, New Jersey, New York, and Wisconsin studies having to do with toll roads authorities, the Los Angeles study, and the Minnesota study. Records singled out the Virginia Department study as the largest single one which had been carried out to date. This effort lasted over a three-year period and was designed to cover nearly every major aspect of maintenance. The uniqueness of this study was its all-inclusiveness. Records noted that currently the maintenance management research program includes thirteen formal studies which are fully active. Eleven of these are being financed through the Federal-aid HPR program. The estimated total cost is over $2 million and the annual expenditure is about $700,000. The nature and scope of these studies vary considerably. Six can be classed as comprehensive because they cover several aspects of maintenance management; five deal with the equipment and methods for specific activities; two are concerned with cost.

Paper sponsored by the Committee on Maintenance Management to be presented at the 48th Annual Meeting.

The next presentation was by Colonel P. J. F. Wingate, Principal Scientific Officer, Road Research Laboratory, Ministry of Transport, London, England. Colonel Wingate spoke on the concept of maintenance management problems insofar as they have been established by preliminary investigations in Great Britain. He reviewed the overall content of the problems and mentioned the specific tools that management was then using to approach the solutions. He felt that in Great Britain they must start logically by getting the maintenance task right, that is, by setting standards correctly. Then they must get administration and organization right so that they can know what is going on so that planning and controlling can be done correctly. Finally, they must ensure that what is being done on the site is being done in the most efficient manner.

H. O. Sheer, Engineer of Maintenance, and Nile Blood, Engineer of Cost and Planning, Illinois Highway Division, next gave a progress report on the Illinois management program. They noted that a short report of the Illinois concept of highway maintenance management and performance rating was presented at the HRB Annual Meeting held in Washington in 1968 and that they were restating a few of the major features of the system. They described the roadway inventory system and the necessary forms used to maintain this inventory. They have attempted to design a simple system, especially in the field report phase. Planning and scheduling of work were encouraged when feasible, although formalized scheduling was not a part of the system. No actual job time studies had been made. They expect to develop performance standards from actual average unit cost which they are recording over a period of time. In summary, they noted that the present status of the Illinois system included the first roadway inventory summary, a basic report from the work accomplishment phases, the first cost reports, and the equipment usage reports.

Allen Leslie and A. P. Cunliffe presented the Ontario approach to maintenance management. Many are familiar with this project since it has been reported from time to time. An interesting approach which seems unique to the Ontario study is the recognition of the system as a dynamic one such that quantity standards, production rates, and methods of performing work come under continuous scrutiny and are revised and reshaped according to changing conditions. Planning is thus based on current information, thereby allowing maximum utilization of all resources in the achievement of the design level of maintenance service at the lowest practical cost.

V. L Dorsey presented the State of Washington's approach to maintenance management. He concluded that the system which was developed and installed has obtained the general acceptance of the employees of the system and that they are very optimistic about the future. A unique aspect of the Washington study is the recent heavy unionization of the Highway Department. At times, there were union representatives attending the training sessions where the maintenance management study was being initiated. Dorsey emphasized the tremendous amount of work required to see such a program through to a successful conclusion. He further emphasized the extreme importance of taking the program to the people and getting maintenance employees directly involved. In his words: "This is absolutely necessary to avoid the resistance that is all too often encountered when new programs are undertaken to displace long established habits."

L. G. Byrd spoke on "The Use of Pavement Evaluation Techniques in Maintenance Management." His thesis was that in order to evaluate maintenance, a systematic and formalized pavement evaluation technique should be developed. He reviewed the existing techniques emphasizing the advantages and disadvantages of each and recommended future work in the field.

John Swanberg gave a presentation on the Minnesota study, "Work Standards and Programmed Budgeting for Maintenance Operations." He also emphasized the difficulty of the transition to the new system. On the other hand, he found the program budget to be a management tool that can improve management's long-range planning, fiscal budgeting, performance evaluation, and decision-making. The program budget achieved benefits in the following ways:

1. It reflected the objectives, goals and policies of the organization;
2. It indicated approved plans and work programs geared to meeting the goals and objectives;

3. It provided a financial picture that indicated the cost as related to the expected result in carrying out the work programs; and
4. It presented results reflecting outputs and cost.

Swanberg's presentation and report included a number of forms, standards, scheduling techniques, and reports.

"The Application of Industrial Engineering to Maintenance Operations in New Jersey" was presented by J. F. Andrews, Director of the Division of Maintenance and Equipment for New Jersey's Department of Transportation. Andrews is the new chairman of the Highway Research Board's Department of Maintenance, succeeding John Murphy of California. It appeared that his argument for inclusion of industrial engineering techniques into highway management work was a strong one. Andrews said that the great strength of bringing industrial engineers in is that they bring a methodology and a freshness of viewpoint. Industrial engineers are usually enthusiastic with zest for improving methods, systems, cutting costs, and training. Entering the world of highways, the industrial engineer has no mental roadblocks induced by tradition worn-out policies, governmental budget processes, and politics. The industrial engineer is willing to challenge the status quo and reprocess it. The weakness that Andrews emphasized was the fact that the industrial engineer is usually trained in the industrial, hardgoods type industry field and that he must reorient his thinking to the highway frame of reference. Andrews emphasized the suspicion among government employees as to what new personnel and new systems were going to do to their entrenched operation. At this point, he mentioned that all of these problems are possibly encountered by the industrial engineer in the industrial atmosphere as well as the highway atmosphere. He says that in his opinion the strength overcomes the weaknesses.

Jim West, Engineer for Maintenance, Utah State Department of Highways, presented "A Scheduling and Performance Evaluation System for Utah's Basic Maintenance Mangement Units." Utah has recently undertaken the development and implementation of a computerized maintenance management system. The components of this system include performance standards, a maintenance management reporting system, planning processes and performance evaluation techniques. West went on to say that their computer system is not designed to schedule their basic management units or provide short-range operating guidances.

The development of the system required an evaluation of characteristics of Utah's particular organization. The major factors considered important in the development of the system follow:

1. First-line supervisors most of whom have high school education.
2. First-line supervisors who have traditionally been working members of crew.
3. Basic management units which are physically separated from each other and from their respective district headquarters by considerable distances.
4. Basic management units most of which require a staff of only 4 to 6 men.
5. Performance standards which have been and will continue to be developed to provide first-line supervision with operating guidelines.
6. First-line supervisors who have traditionally been responsible for need identification, scheduling, and performance of a majority of the maintenance activities.

The resulting scheduling and performance evaluations systems design can best be described as one which is noncomputerized; which continues to place considerable managerial responsibility on the first-line supervisor; which minimizes the time labor between performance and evaluation; and which incorporates performance standards.

The performance evaluation procedure involves a comparsion of actual performance with performance guidelines. Indications of actual performance are provided by data from the reporting system and actual field observation.

C. O. Leigh described some of the problems encountered in developing and installing a maintenance management reporting system in Virginia. His primary problem appeared to lie in the area of computer programmers and in the time lag between the reporting process and receiving reports from the computer. It appears that these problems will not necessarily be encountered by all who enter into a computerized

system but make themselves felt when it is difficult to get and retain satisfactory computer programmers.

Forrest E. Crawford and Melvin Jackson, Louisiana Department of Highways, spoke on implementing findings from the Louisiana maintenance research project. Their discussions were divided into two parts. The first part described the project results to date and included a discussion of the background of the project and a report on the results of the major phases. Particular emphasis was given to the management reporting process, maintenance planning and changes in organization. The second section concerned experience in implementing the study. This included a discussion of the performance laboratory where basic data were gathered and methods reviewed. The performance laboratory aspect seemed to be of most interest to the audience. This was not a laboratory in the sense that all work was simulated in a building or within four walls. The performance laboratory merely meant a group of people who studied, mostly in the field, jobs which were of a repetitive nature and which could be "standardized." The Louisiana study was of considerable magnitude and permeated the whole maintenance organization.

Moving from the state highway frame of reference to the county and city approach, David K. Speer, County Engineer for the County of San Diego, California, presented the county's idea of a maintenance management system. That system had been in operation only about 4 months when the conference was held, and it was still too early to recognize tangible quantitative benefits. Dollar savings are anticipated and data are currently being accumulated. He noted that immediate quantitative benefits had been realized in the form of increased efforts on the part of the maintenance personnel to recognize and use methods improvement, priority ratings, and overall planning and scheduling.

One significant difference noticed by the group between the state highway situation and the county and city situation was the significant differentiation in the salary structure. The latter group was compensated considerably better than were the state highway workers.

Lawrence C. Jones, Director of the Bureau of Street Maintenance for the City of Los Angeles, gave that city's approach to maintenance management. It was interesting to note that the Bureau of Street Maintenance employed about 2,300 civil service employees and had a budget for the current fiscal year of over $27 million. It also maintained a fleet of approximately 1,900 units. Although the City of Los Angeles, with only 464 square miles and 7,275 miles of streets and public ways to maintain, was considered geographically small, the size of the street maintenance group approaches that of a state highway. Jones noted that the application of industrial engineering principles indicated 149 maintenance laborer positions (of a total of 472 studied) could be eliminated. Reduction was achieved by attrition in conjunction with an upgrading of 32 field positions. To date, the installation of the program within the bureau has produced a net savings of $4,339,344 for the city. The report also documented other savings. The audience was particularly interested in getting firm improvement figures resulting from maintenance management systems and, as a result, this presentation was of much interest.

The last three presentations concerned satellite problems of the maintenance management system. Charles Diehl of the Stanford Research Institute spoke on "A Researcher Looks at Maintenance Management—in a 'Systems' Context." He described the use of the systems analysis approach in the maintenance management environment. He indicated some general tools that he felt might be helpful in such an analysis and suggested some unanswered questions that engendered a feeling that there still remains a considerable amount of research to be done in order to come up with a really effective highway maintenance management system. The questions raised included: Do we have a reliable way of accumulating our costs so that the designers can look at the total cost of a highway from both a capital and operating standpoint? Are there restrictions on our operations because of funding situations that force us into illogical decisions because we must follow the money chain?

Lawrence Mann, Jr., presented "An Industrial Engineer Looks at Maintenance." The essence of these remarks was that the industrial engineer and his techniques have

a real place in highway maintenance management and the training that the industrial engineer gets seems to prepare him for this type of work. Some problems exist as to whether there should be an industrial engineering department in the highway department or whether industrial engineers should be sprinkled throughout the organization so that their technology can permeate the entire maintenance structure. The paper listed some industrial engineering techniques, and with each technique, an application in the highway maintenance field was given.

The last paper was entitled "Cost Effectiveness as a Measure for Setting Maintenance Levels and Priorities." Professor C. H. Oglesby, Department of Civil Engineering, Stanford University, took a preliminary look at how cost effectiveness can be applied to decisions on highway maintenance. He also briefly explored the forms that analyses to measure cost effectiveness will take and the problems that will be encountered in carrying them through. In addition, he examined the question of giving decisions regarding highway maintenance greater sensitivity to the wishes of the public who pay the bill. Professor Oglesby concluded that cost effectiveness was an advanced and valuable aid to decision-making and is a fruitful area for future research and development.

After the presentation of the papers the group was divided into four sections of approximately 30 individuals each. The sections then met individually with teams from Ontario, Louisiana, Los Angeles-San Diego County, and Washington. The purpose of the group seminars was to allow the participants to ask questions of the representatives of those states which were conducting the maintenance management program. The group seminar approach seemed to work very well in that the participants felt no hesitancy in asking questions of the representatives of the above-mentioned states, and actually this was the purpose for holding the program, that is, making known to the states which did not have a maintenance management program the experience of those states which were conducting such a program.

The questions seemed to center around four particular topics: topics included the role of consultants, the source of man power to act as liaison between the consultant and the state highway department, how to sell the program to the highway administration, and how to sell the program to the maintenance people. Another source of discussion was the place of the industrial engineer and industrial engineering techniques in the maintenance management field.

In summary, it is my opinion that the maintenance management seminar was most successful in achieving the goals which were stated as the purpose for the seminar. Each participant went away with a complete set of notes and with a good idea of what such a program can do for his state. Further, he has a list of individuals in the highway field that he can call upon if he wants further information about such programs.